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THE HAT CONFORMATOR AND ITS DIAGRAMS.

Every one who has purchased a stiff hat, whether of silk or felt, has undoubtedly observed that although there may be a dozen hats submitted to him, each bearing inside the number corresponding to the size which he generally wears, yet he may try on perhaps ten out of that dozen before he finds one which comfortably fits his head. If he seeks a reason, it will be shown him that hats are usually made of an average shape, and that the size number means the mean diameter of the figure bounded by the periphery of the opening; and further, that slight accidental variations from the typical shape often correspond to variations in individual heads. Where no hats in which the desired variation exists can be found in the stock of the seller, then the customer usually purchases the nearest approach to a fit that he can obtain, and departs with the conviction that there are several places around his head between which and the hat there is no contact, while elsewhere there is a pinching which augurs of future headaches. The first difficulty is usually overcome by wads of paper stuffed in under the hat lining, and the other is obviated in course of time by the stretching of the hat after it becomes softened by the warmth of the wearer's head.

From the period when stiff hats were invented up to 1843, people put in extra linings and converted their craniums into hat blocks—and they do so yet, wherever the very ingenious conformator, invented by M. Allie, of Paris, France, in the above named year, is not in use. All who have visited hat stores in large cities have probably viewed the workings of this apparatus with some curiosity. It resembles a hat, and in a mysterious manner it adapts itself to any one's head the instant it is tried on. While the customer is experiencing the novel sensation of wearing a self-fitting hat, made of 610 separate pieces, he hears a click, and from somewhere in its crown the hatter removes a scrap of paper on which is pricked a diagram, and departs into an inner chamber with said slip, and also the particular hat which the customer fancies, but which refuses to adjust itself to its would-be owner's cranial peculiarities. After a moment's delay he returns, the refractory hat, with some misgivings, is tried on again, and the customer, this time discovering that it fits like a mould, departs lost in speculation as to how it all was done. This we propose to explain, and at the same time to examine briefly some curious facts which are adduced by the conformator's aid.

The apparatus itself is fully illustrated in Figs. 1 to 7, Fig. 1 showing it as adjusted on the head. It has the shape of a hat brim and crown, and is formed with sixty small branches of ebony, A, plated at the edge of the rim with mother-of-pearl. These are held by a brass spring wire, B, which keeps the branches close to the frame in which they slide. When not in use the inner arms of these branches together form an elliptical cavity, but when the conformator is placed on the head, every projection thereon pushes the branches more or less outward, the wire spring yielding as indicated in Fig. 4, and the cavity consequently assuming an irregular shape.

On top of the instrument there is a lid, E, Fig. 1, lined with cork. On this a small piece of paper, about three and a half inches long by three inches in diameter (Fig. 3) is placed and clamped by the ring, D. It will be observed from the sectional view (Fig. 2) that the upper inner arms of the branches, A, do not meet in the center of the crown of the hat, but form an elliptical or otherwise shaped aperture, as shown in Figs. 4 and 5, corresponding of course exactly to that of the cavity which conforms itself to the shape of the head. At the inner end of each arm is a sharp steel point, and upon these sixty points the paper, when the lid, E, is closed, is pressed. It will be clear that the punctures made on the paper will register in reduced scale the size and exact conformation of the head.

The hatter when he takes the paper to his workroom cuts it all around just outside of the punctures, and places it upon two points in a small frame in the apparatus represented in perspective in Fig. 6 and section in Fig. 7. As the two points hold the paper, or "conform," as it is technically termed, in position, a brow, equally made of branches, F, forty-six in number, after being expanded from the middle to allow the paper conform to be placed in the center, is put on the frame above mentioned; and then the branches are gently slid back so that they touch the edge of the paper all around. When this operation is done to a nicety, eight thumbscrews, G, are tightly screwed down so as to prevent any moving of the branches, and it is ready for use as a block giving the natural shape and size of the head. It only remains to warm the hat, force it down upon this block, and let it cool thereon, to cause it to become an exact fit. In other words there is thus accomplished in a few moments that which when done by the natural warmth of the wearer's head occupies a week or two, and involves considerable discomfort. The conformator is manufactured only by the inventor in France. Attempts, we are informed, have been made to produce the in-

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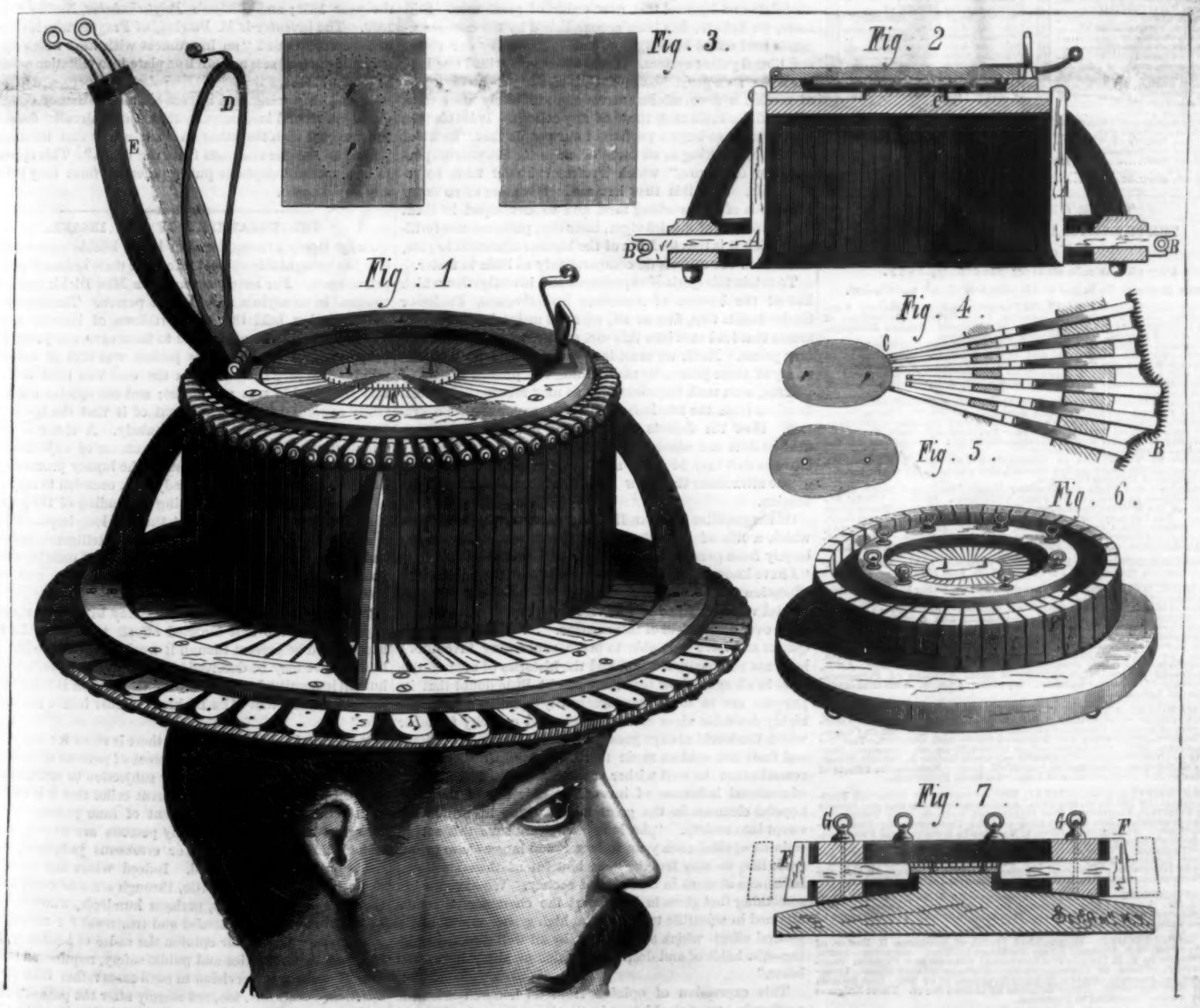

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INVENTION AS A MEANS OF CULTURE.

Next to a passion for personal freedom a zeal for material conquest has always been the dominant characteristic of the Germanic race. The culmination of that spirit naturally finds its latest expression in the national character of our own composite people, the offspring, so to speak, of the most active and independent elements of Germanic life.

Within a century we have conquered a wilderness as large as that which our immediate ancestors had been two thousand years in subduing. And not less rapid and sweeping have been our conquests in the finer and more difficult domain of the forces of nature. We are a nation of investigators and inventors, not, as has been said, because we are possessed by an overwhelming greed of gain, but rather because we are impelled by an irresistible thirst for action and achievement.

The American people are not remarkable for their ability to get or their desire to hold wealth as an end; we are noted rather for lavish expenditure and open-handed liberality. For the most part riches have come to our men of wealth incidentally. The primary object has been the mastery of some department of commerce, some material conquest, some victory over the forces of nature, or the achievement of some difficult end through successful invention.

With this exception we are thoroughly in sympathy with the views expressed in Professor Shaler's suggestive essay on the "Effect of Invention on National Culture," and the need of taking more account of national impulses in the work of education. It is unhappily true, as he points out, that our popular theory of education is framed on the needs of centuries gone by, when the only classes that could make use of education were those separated by occupation into the so-called professions. It is a theory that "has not the least adaptation to those conditions which business industry brings to life," and the practice of our educators is little better than their theory. With all the advances made of late years in our regular means of education, "but little is done to touch those great masses of men who are to live by their brains, but are to use their brains in the counting house, the shop, or the manufactory."

Meantime whence comes the high average intelligence, the broad and often high culture of the great army of *Doers* who have given our age and country so much of their character and fame? The schools have had very little to do with their development. The public press, particularly scientific and industrial publications, have done far more to stimulate and instruct this new order of great men. Still more, we believe, has been accomplished by the encouragements held out to investigators and inventors by our cheap and liberal patent system. Years ago we described our Patent Office as a great National University, whose diplomas of merit for successful endeavor were infinitely more valuable and desirable than those of any college. It is this that has given to so large a portion of our people that "habit of continuous seeking in all sorts of ways for the untried possibilities of nature," which Professor Shaler finds so remarkable. It is this that has made inventors of so many thousands of our working men, and so developed in them those qualities of mental vigor, intensity, patience, and fertility, which it is the chief aim of the highest education to give, and which our schools do comparatively so little to foster.

To retain this spirit of experiment and investigation which lies at the bottom of American inventiveness, Professor Shaler insists that, first of all, we must maintain the inducements that lead men into this sort of life, namely, its pecuniary prizes. Next, we must increase the efficiency and certainty of these prizes, by maintaining the present system of patents, with such improvements as may secure the greatest freedom from the frictions which now embarrass its operation. How the defects of our patent laws are to be remedied he does not attempt to show; he only asks that any changes that may be made shall not diminish the intensity of the attractions that now lead men into the paths of invention.

Of the peculiar and excellent character of the education which a life of invention gives, Professor Shaler speaks largely from personal acquaintance with inventors. He says: "I have known several men of no other than the preliminary education of the common schools, who have extended the mental vigor, attained in this vigorous grapple with natural laws, over a wide field of information. . . . Such other inquiries as I have been able to make concerning inventors I have not personally known, and the histories of men of this class in all ages, show that there can be little doubt that its pursuits are in some way necessarily connected with the highly desirable vigor of intelligence and capacity for labor which the world always greatly needs in all its avocations, and finds but seldom made to its hands." Further on he remarks that the well wisher of the State must feel that this educational influence of inventiveness is one of the most hopeful elements in the great tide of trade life which has swept into society. "As long as we can have this sort of training applied each year in larger and larger share to our trade life, we may feel the more hopeful of the educational influences at work in that part of society. We have therein something that gives in large part the character of results attained in scientific training of a high grade, as well as the general effects which are attained by all well directed training—the habit of and desire for continuous absorbing mental labor."

This expression of opinion from an honored scientific teacher in one of the highest institutions of our land ought to be very encouraging to the young mechanics and others who feel that in them the spirit of invention is thwarted and held back by lack of information and mental training. It is equivalent to saying: Go on inventing; study, think, try; you are in the best of all schools; a grateful nation stands ready to certify and reward your successes; and even your failures will be valuable to you through the training the effort involves and the widened knowledge they will give of the forces and mechanism of nature and art.

THE GENESIS OF THE TELEPHONE.

It is a curious fact with relation to the telephone, and Professor Dolbear in his little work on that instrument makes, we observe, especial note of it, that there is not a single principle involved in its construction which was not known in 1840. That sound in air would cause vibration in a solid iron body, that this iron acting inductively upon a magnet would originate magneto-electric currents in a wire helix around that magnet, that these currents passing to another helix would react upon a magnet inclosed therein and increase or decrease its strength, and that said magnet could be made to influence an iron body in front of it—all were separately well understood. Professor Page three years before the date mentioned showed that a rod of soft iron temporarily magnetized elongates, and when deprived of its magnetism suddenly regains its original length, at the same time emitting a sound. Here was the first transmission of sound by the electric current. It would not be difficult to go into more minute detail and dissect almost any other modern invention, and point out the fact that its principles have long been known. But scientific investigators are not necessarily inventors. They question nature and record her answers. As time advances this accumulated knowledge becomes digested, subjects at first widely separated are brought together, sometimes by chance, sometimes by keen minds seeking solutions of problems which check their progress to some particular goal, and thus ultimately great adaptations of incalculable value to humanity, but perhaps never dreamed of by those who contributed so directly to their existence, are reached.

It is still more remarkable, however, that evidence is at hand showing that the telephone was invented many years ago and forgotten. It is generally supposed that Reiss, in 1861, was the first to use vibrating membranes or thin plates. Professor Sigismund Beer sends us an account of a "new musical instrument," which he finds in the *Berliner Musik Zeitung Echo*, No. 33, *Dingler's Journal*, vol. 126, both for the year 1852; and *Böttger's Polytechnisches Notizblatt*, for 1853. The inventor is M. Petrina, of Prague, who is stated to have constructed "an instrument with keys which by a galvanic current sets a small iron plate into vibration as soon as the hand leaves the key. Each key produces a different tone, and the tuning and use are similar to that of a pianoforte. A second instrument put at a considerable distance is connected with the other in such a way that the music played on the one resounds from the other." This appears to be a musical telephone put in practical form long before any now known.

THE TREATMENT OF THE INSANE.

Judge Brady's recent decision in the Dickie case in this city has brought this subject into more than ordinary public prominence. For nearly seven years Miss Dickie had been confined in an asylum as an insane person. The officers of the institution held that the certificate of insanity under which she had been committed to their care was justly and properly given; and that the patient was still of unsound mind. The jury before whom the case was tried decided that Miss Dickie was not insane; and the opinion has been freely expressed in court and out of it that she has never been afflicted with that terrible malady. A sister of Miss Dickie (through counsel) raised a number of objections to the report of the Commissioners in the lunacy proceedings, in overruling which Judge Brady took occasion to say:

"It cannot be denied, assuming the finding of the jury in Miss Dickie's case to be correct, that her long imprisonment is a disgrace to our boasted civilization, intelligence, science, and justice, and imposes upon us the duty of creating every possible preventive against a similar outrage and disgrace. . . .

"The subtle thing called insanity may baffle even vigilant experience in the best directed efforts to discover its existence, and be present though it would seem not to be. In this case we may be deceived; but, applying the tests which human ingenuity has devised, the declaration is legally and properly made that Miss Dickie is neither insane nor imbecile."

It may be freely admitted that there is room for many and great improvements in our treatment of persons of unsound mind both before and after their subjection to restraint and medical treatment. But the current belief that it is an easy matter to secure the confinement of sane persons on the charge of insanity, or that many persons are wrongly committed through conspiracy or erroneous judgment, does not seem to be well founded. Indeed where one person is unjustly confined as a lunatic, through error or conspiracy, there are probably scores, perhaps hundreds, who ought to be but are not under restraint and treatment for mental unsoundness. And in our opinion the cause of humanity, not less than that of justice and public safety, requires an extension of sanitary supervision in such cases rather than its restriction. And this, too, not merely after the patient's commitment, as Judge Brady suggests, but before it, with a view to making confinement unnecessary.

We do not mean that on the first indication of mental disorder the subject is to be haled before a court and put on trial for his liberty: that were quite as bad as the present custom of allowing the disease to go on unchecked until it becomes chronic, perhaps incurable, before anything is done to protect the patient, his family, or the public, and then proceed at once to violent measures too often calculated only to aggravate the complaint. What is needed is rather some legal means of bringing incipient insanity under proper treatment with the least possible interference with the patient's rights and wishes. In the majority of cases the access of insanity is slow, and if taken in time the disease yields readily to proper medical and moral treatment. The great sanitary problem is therefore to secure the earliest possible attention to the first signs of the coming malady; if this could be done in every case, it is safe to predict that the over-crowding of our insane asylums would soon come to an end.

Perhaps the most that can be accomplished at present is the dissemination of right views touching the causes and symptoms of insanity, and the vital necessity of immediate action when such symptoms begin to appear. There is a world of ignorant prejudice to be overcome on these points. Multitudes of otherwise intelligent people still believe that insanity is a purely mental malady, independent of physical causation; that there is something peculiarly terrible or degrading in mental disorders, justifying concealment, even willful non-recognition, till the last moment; that insanity implies entire loss of reasoning power; that the insane are always violent or liable to fits of violence, and so on. As a natural consequence, most people, in the absence of maniacal demonstrations, refuse to admit a suspicion of insanity on the part of friends or relatives, until the case has gone beyond control.

So long as extreme measures for the restraint of the insane are the first and only ones taken, we may expect to see patients, in the majority of instances, too long left to themselves, particularly where property is involved and the instigators of legal interference are liable to suspicion of corrupt motives. When it comes to be generally recognized that the kindest interference in such cases is the speediest, and that any marked change in or exaggeration of the habits of thought, feeling, or conduct of an individual, in the absence of rational cause, is a sign of mental disturbance that may culminate in mental wreck, a long step will have been taken toward the general prevention and cure of this distressing disease.

The problem, how, and by whom, and to what extent, such preventive interference is to be made, is one of extreme delicacy. To neglect such timely interference is in most cases to suffer the patient to go on to mental and physical destruction, often to the bodily or other material harm of others. To undertake such duty unwisely or rudely is to open the way to gross injustice and exasperating interferences with personal freedom. But because the duty is difficult is no good reason for our neglecting it; and just as the community is justified in requiring the seclusion of persons afflicted with or exposed to infectious diseases, or in insisting upon such preventive measures as vaccination, so we believe it would be justified in bringing under supervision incipient as well as violent or chronic insanity.

Managed discreetly, such supervision would be the surest of all safeguards against the possible seclusion of sane persons in public or private hospitals for the insane. For instance, suppose it should be made the duty of the family, family physician, or immediate friends to report at once to a properly constituted board of health the reasons for suspecting mental change in the direction of insanity in any individual. This without publicity; the first duty of the sanitary board being to have the case privately investigated by a committee of experts. Should this examination prove the suspicion well founded, the subsequent steps would be determined by the more or less critical state of the subject. In the majority of instances it would probably be sufficient to advise the patient of his need of medical treatment or a change in his mode of living through rest, recreation, lightened labor or the like. Should this fail to stay the progress of the disease, or should the disease have gone too far to be arrested by such means, compulsory treatment might be resorted to, still, if possible, without otherwise restraining the patient of his liberty of action. Should the case seem to justify immediate and forcible interference with the patient's freedom, the patient should be brought into open court and formally tried; or if the case be still more urgent, he might be committed to an asylum on the certificate of two or more physicians, as now, and the case regularly tried before a jury of physicians within a limited time thereafter. In some such way as this it might be possible to prevent absolutely the permanent commitment of a sane person; and at the same time it would in multitudes of cases prevent the neglect of patients until it is too late to do them any good.

To prevent the continued imprisonment of patients who have recovered their mental sanity, the periodic examination of all the inmates of public and private asylums should be undertaken by the sanitary board; the examining committees to be composed of experts not connected by kindred or social or business relationships with either the patient or the persons having him in charge.

Bearing in mind the concurrent testimony of all who have had to do with the insane, that the patients usually reach the asylums long after the disease has ceased to be readily amenable to treatment, we are persuaded that the cost of such sanitary boards as we have suggested would be saved many times over in reducing the number of incurable inmates of our asylums, let alone the greater saving of life and health and usefulness which early treatment might effect.

FISH TEETH SET ON HINGES.

It was discovered many years ago that the mouth of the angler (*Lophius piscatorius*) is furnished with hinged teeth, capable of bending inward toward the throat when pressed upon, and springing back to an upright position when the pressure is removed. For a long time this feature was supposed to be unique, but in 1866 Professor Owen showed that a similar arrangement existed also in two other fish, namely, *Anableps* and *Pœcilia*. An English microscopist (Mr. Chas. S. Tomes) has lately discovered that several other predatory fish, notably the hake, and in a less degree others of the *Gadidæ*, present a like condition of teeth, and still more remarkably, the common pike.

In all these cases the hinged teeth have certain characters in common—they all yield to slight pressure, but in a single direction only, being rigidly immovable to force applied in any other direction. The mechanism by which this result is attained is, however, very different in the different species.

In the angler and the hake the teeth which are hinged form the inner and larger of two rows of teeth set upon the margin of the jaws; their mobility being useful in facilitating the ingress of the fish's prey, but opposing its escape. In the mouth of the pike, on the other hand, the marginal teeth are rigidly anchylosed, and the hinged teeth are situated on the vomerine and palatine bones, and are useful only in making easy the swallowing of the prey.

In the angler and the hake the elasticity of the teeth resides solely in the tissue of the hinge; in the pike the hinge is not at all elastic. It is purely a hinge, the power of movement coming from bundles of very elastic fibers which proceed from the interior of the dentine cap of the tooth, and run down to the bone on which the tooth rests. These filaments are calcified and rigid where they start from the dentine cap, and apparently again where they are blended with the bone, but their intermediate portion remains soft. Mr. Tomes thinks it highly probable that other predatory fish will be found on examination to be similarly furnished.

A BRIEF HISTORY OF OUR PATENT SYSTEM.

The Constitution of the United States provides that Congress shall have power to promote the progress of science and the useful arts by securing, for limited times, to authors and inventors the exclusive right to their respective writings and discoveries. Acting upon this authority Congress passed the first patent law, which secured to inventors the sole and exclusive right to make and sell their inventions for a term of fourteen years, upon complying with certain conditions. This law was approved April 10, 1790, and remained in force three years, when it was repealed. During the first year of its operation, but three patents were granted; the second year the number was increased to thirty-three; and the next year the number declined to eleven.

The second patent law, amended from time to time, remained in force until 1836. One of the first patents granted under it was for Whitney's cotton gin, an invention which good authority has pronounced of more worth to the country than the whole cost of administering the patent law from the beginning till now, "including the expenses attending the litigation of patents." During the first ten years, the last decade of the eighteenth century, the number of patents granted was 266. In 1819 the infringement of patents was brought under the equity jurisdiction of the Circuit Courts of the United States. In 1832 provision was made for the reissue of patents which should be inoperative or invalid owing to any incompleteness or error in the description of the invention, made without fraudulent or deceptive intention.

Previous to 1836, when all existing patent acts were repealed and a new law was passed, the number of patents issued amounted only to 10,020; since then the number has increased to over 200,000. This third patent law, with certain modifications, remained in force until 1870, when it was revised, but not essentially altered. The term for which patents were issued was extended in 1861 to seventeen years. By the act of 1870, the Patent Office was created as a branch of the Department of State. It has since been attached to the Department of the Interior.

The law was again modified, though not materially, in 1874; and still further changes, chiefly for the benefit of infringers, are now pending the action of Congress.

THE ASTOUNDING FAMINE IN CHINA.

The startling news is telegraphed, on apparently good authority, that no less than seventy millions of human beings are now starving and likely to perish in the famine stricken districts of northern China. The distress resulting from so widespread a calamity is almost incalculable, but some view of its enormity may be gained from the consideration of the fact that the infliction directly reaches a sixth part of the vast population of China, and that the number of sufferers exceeds by fifty per cent the entire population of the United States, and nearly equals the combined populations of all the nations of North and South America. Such news is indeed appalling, and seems to preclude the hope of effective relief. It is thought by some persons that the famine may add to the existing complications attending the immigration of Chinese to this country, by acting as a fresh incentive to drive them from their own land; but it seems to us that a moment's consideration should lead to the opposite view. So overwhelming a desolation must necessarily diminish both the number of emigrants as well as the means for emigration.

HAYFORD'S WOOD-PRESERVING PROCESS.

The various processes for preserving wood have for their object the prevention or arrest of fungoid growth. This is sought to be accomplished by two main systems; one of which consists in impregnating the wood with a solution of a metallic salt, such as corrosive sublimate, chloride of zinc, or sulphate of copper, and the other includes the several creosote processes. The action of the salts named is purely chemical, and as they are introduced in watery solution, it is evident that subsequent exposure to moisture tends to redissolve them and leave the wood unprotected. Creosoting, while producing the same result chemically, also secures dryness, which alone is sufficient to prevent decay, provided that it can be maintained.

In creosoting, it is essential that the wood should be thoroughly dried, in order to secure complete impregnation, and hence timber is usually seasoned for months before treatment. This is a serious objection, which inventors have attempted to remedy by adding a preliminary desiccating operation. At extensive works at South Boston, Mass., under the charge of Mr. Edward R. Andrews, a process known as the Hayford is in use, which consists in drying the timber *in vacuo*, and then impregnating it with creosote oil under pressure. Green timber is fed by a rail track into an air-tight cylinder of boiler iron, 100 feet long and 6 feet in diameter. This cylinder has been tested by hydrostatic pressure of 200 lbs. to the square inch, and is capable of being hermetically closed. When the charge is in, steam is introduced, raising the temperature gradually, so as not to harden the outside of the wood and prevent the escape of moisture from the interior. Atmospheric air is also forced in at a pressure of from 30 to 40 lbs., to restrain the tendency of the wood to crack. A temperature of 250° to 270° is found sufficient to evaporate the sap, and the whole steaming process occupies from 4 hours for boards to 10 or 12 hours for heavy timber. When it is certain that the sap and vapor have been turned into steam, the direct steam is shut off, and air pumps set to work to free the cylinder from the steam, vaporized sap, and condensation. This stage is reached in about an hour. The cylinder being made tight again, and still heated by the coil, a vacuum pump is put in action. Then the creosote oil, previously heated to near the boiling point to render it limpid and penetrating, is introduced under a pressure of 60 lbs., which, added to the drawing power of the vacuum, makes a total pressure of over 70 lbs. to the square inch. The hot oil soon impregnates the wood. If the timber is of very close fiber, the pressure is raised to a higher point. The process completed, the charge is withdrawn and another takes its place.

Wanted—A History of American Inventions.

In the printed histories of our country a thousand pages are devoted to political conflicts, civil and foreign wars, and other obstacles to national progress, where one page is given to the real springs of our phenomenal growth and prosperity—the achievements of our inventors. Great as has been the influence of some of our soldiers and statesmen, much as we are indebted to their wisdom and courage for the privileges we enjoy, they have done comparatively little to make this country what it is. They fill the larger space in the annals of their time, but their real influence has been slight compared with that of inventors like Whitney and Fulton and Morse and scores of others, who get no mention, or but the briefest notice, in our current histories. Indeed the real history of the American people is yet to be written. And any young writer, who will bring to the investigation of American inventions, and their social, industrial, and political effects, the patience, persistence, and enthusiasm which Parkman has devoted to the study of New France, or Motley to the records of the Dutch Republic, will find the field infinitely more fertile and interesting than any hitherto explored; and if he possesses the requisite qualifications he may be sure of an attentive hearing and an honorable fame.

Increase of Insanity in London.

The experience of the London Metropolitan Asylums Board is that imbecility, idiocy, and insanity are largely on the increase in that city. The Board have purchased 100 acres of land at Darenth, Kent, where an asylum to accommodate 500 idiot boys is being erected. A Committee of the Board will consider a proposal to build another asylum on the same estate for the accommodation of 500 imbeciles. The City of London and other asylums for the insane exist in the same neighborhood, the space to be devoted for the accommodation of the mentally afflicted of London being as large as the area of the whole of that city. Drunkenness, violent tempers, the worry and uncertainty of business, and other preventable causes of insanity are found to far outnumber the cases of hereditary predisposition.

TEMPERATURE OF FLAMES.—F. Rosetti finds the temperatures of the flame of the Bunsen burner to be in the external envelope, 1,350°; in the violet portion, 1,280°; in the blue, 1,200°.

Better a dog that works
Than a lion that shirks.

[*Continued from first page.*]

strument here, but its multiplicity of parts renders it very expensive, while the demand for it is small. The present cost of the French instrument is about $100.

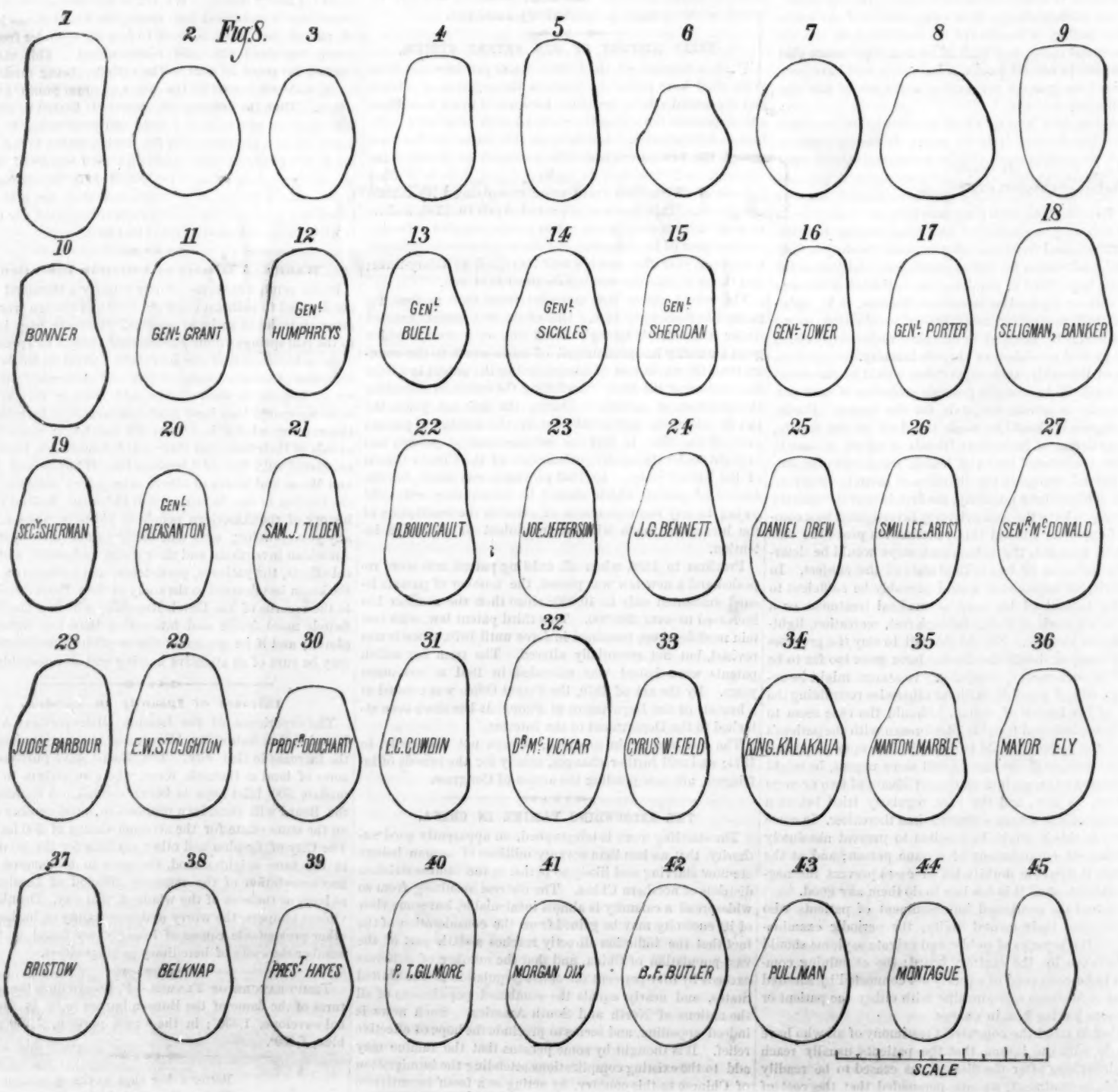
Apart from its utility to hatters and their customers, the conformator is employed for scientific investigation in the study of anthropology, or rather of that branch of the science known as craniology. The object of the observer, says Virchow, "is to detect a definite connection between the shape of the cranium, the conformation of the face, and the structure of the brain." To this end large numbers of skull measurements are taken reaching down to the minutest details. Kopernicki has made no less than 139 such measurements. Unfortunately, however, there is much disagreement as to how the measurements should be regarded, or how many even in number they should be; so that while in the end some important general laws will probably be based upon them, at present there is not much to be deduced. Some curious facts are, however, obtainable by observing relative lengths and breadths of skulls, and for this purpose the conformator is excellently suited to assist the student. In these investigations the longitudinal diameter is rated as 100, and the lateral diameter is expressed in a percentage of the units. This percentage itself is termed the "index of breadth." Completely circular skulls, Peschel says, of which the index of breadth amounts to 100, and even more than 100, occur both in North America and among the Peruvians and the Chibcha of New Granada; they owe their form, however, to an artificial pressure of the skull, and are therefore excluded from comparison. Otherwise complete roundness is most nearly attained by a skull from Tartary, of which 97·7 is the index of breadth. With this Huxley contrasts a head from New Zealand of 62·9 as the narrowest of all known skulls. Bernard Davis has obtained, however, a so-called Celtic skull which has an index of 58, so that these indices for extremes fluctuate between 58 and 98, but the average is only between 67 and about 85.

In order to place before our readers clearly the great difference between the shapes of heads, as brought out by the diagrams made by the conformator, we have obtained from Messrs. Dunlap, Knox, Ernenwein, and other well known hatters of this city, the conforms of a number of abnormally shaped heads, and also those of several distinguished men in different walks of life—all of which are presented on the reduced scale indicated in Fig. 8. In enlarging our drawings by the scale given, the reader will obtain the dimensions of the conforms. Each large division of the scale represents one inch, and each inch division is subdivided in halves. To the measured longitudinal and transverse diameter of these last add 4¼ inches, and the natural size of the head will be obtained.

Nos. 1 to 9 are remarkable for their oddity of shape. No. 1 is an instance of an exceedingly long head, the index of breadth of which is 66, or only 3 in excess of the phenomenally narrow head noted by Huxley. The index of breadth of No. 2 is 93·3, or 4·4 less than the widest known naturally formed skull. Both of these conforms were obtained from regular customers at the most fashionable store in this city. No. 3 is remarkable for its symmetry, a subject on which we shall remark further as we progress. The feature of No. 4 is the exceedingly square forehead. In all cases here given the forehead is toward the top of the page. No. 5 is a good example of the Anglo-Saxon type of head, which differs little in English and Americans, the latter having somewhat the advantage in point of length. No. 6 is the type of French head, which, it will be seen, approaches pear shape. No. 7 is a rare example of an almost uniformly elliptical head, there being very little depression at the temples. No. 8 is an instance of a German head, possessing, as is the rule in all cases of that nationality, considerable breadth. No. 9, as compared with the others, seems reversed, the forehead being broader instead of following the regular rule of being narrower than the back. No. 45 is an exceedingly curious example, the rear of the head narrowing almost to a point.

We shall hardly venture to connect the characteristics of the eminent gentlemen, the shape of whose heads is given in the succeeding examples, with their cranial conformations. King Kalakaua seems to have a head curiously protuberant along the entire left side, and in marked contrast with that of Mr. Manton Marble, whose conform shows protuberance on the rear and almost indentation forward on the same side. The large heads of Messrs. E. W. Stoughton, Rev. Dr. McVickar, and Mr. Seligman, the banker, are noticeably in contrast with the small head of General Pleasonton of blue glass fame. Mr. Joseph Jefferson, the actor, possesses an exceedingly symmetrical skull, and Mr. Eliot C. Cowdin one in which the right side is almost flat. It will also be observed that in almost every example here given—and the same holds true in the great majority of all instances—the left side is most protuberant. It may be surmised that there is some possible connection between this circumstance and the fact pointed out by Brown-Séquard, that the left lobe of the brain comes into greater use, in its control of the right side of the body, than the right lobe, which governs the left side. Still, there can be no general rule safely laid down to account for lack of symmetry in the cranium, any more than one can be adduced to explain differences in physiognomy. It is very probable, however, that outside influences acting upon the soft unclosed skull of the infant in some measure determine its shape, as, for example, a constant habit of resting the head while sleeping upon one or the other side.

As regards the variation in the shapes of the heads of different nationalities, a large amount of statistics has been gathered. Even the average proportions of the skull vary within the limits of the individual races. Welcker has found among the Malays variations from 68 to 82 in index of breadth. In Swedes the average index of breadth is 75·2; Dutch, 75·3; English, 76; Danes and Icelanders, 76·1; Germans as high as 80·1; Croats and Czechs up to 82·1; German Austrians, 78·8; Ancient Greeks, 75; Ancient Romans, 74; but so wide are the variations that it is impossible to infer the racial derivation of a skull from its index of breadth.



HEADS, CURIOUS AND DISTINGUISHED.

IMPROVED FIRE ESCAPE.

The annexed engraving represents a new apparatus for receiving without injury persons or goods falling from windows of burning buildings. The body of the car is supported on springs attached to the axles, and contains seats capable of accommodating several persons. At the corners of the body are vertical tubular posts in which springs are placed, and upon these springs rest standards which support a frame, to which an elastic air cushion is attached. This cushion has a thick rounded edge and a central opening of sufficient size to admit the body of a person. When the apparatus is to be used, it is drawn beneath the window in the building from which escape is to be made, and the person jumping from the window alights without injury upon the cushion and passes through the central aperture to the car below.

Patented through the Scientific American Patent Agency, September 11, 1877. For further particulars address the inventor, Mr. Geo. N. Shishmanian, care of Professor J. W. McGarvey, Lexington, Ky.

SHISHMANIAN'S FIRE ESCAPE.

Mushrooms in Exchange for Eggs.

A late number of the *Journal of Medical Sciences*, of Venice, gives the following account of a curious method in use in Germany for promoting the fecundity of hens:

"In Germany, and more especially in the principality of Nassau, a particular alimentation is adopted to render hens more fecund during winter and those periods when they ordinarily lay but few eggs. All the edible fungi are gathered, dried, and reduced to powder; capsules of linseed are then ground, and one kilogramme of this mixed with two of rye or wheat flour and half a kilogramme of powdered acorns. To this a half kilogramme of the powdered mushroom is added, with sufficient water to form a paste, which is made into small pellets the size of a pea and given to the hens to eat."

THE LIQUEFACTION OF THE GASES—M. PICTET'S APPARATUS.

The engravings hitherto presented, exhibiting the means adopted by M. Raoul Pictet for liquefying oxygen and other gases, were designed simply to exhibit the principle of the apparatus used. We now are enabled to lay before our readers engravings of the exact arrangement of M. Pictet's machinery, for which illustrations we are indebted to *La Nature*. This apparatus is in reality much larger than the general view (from a photograph) given in Fig. 1 would indicate. Its relative dimensions can be approximately estimated, however, by remembering that the height of a man is about equal to that of the manometer, H, from the ground. The construction is shown very clearly in the sectional view, Fig. 2. A A′ is the closed wrought iron tube in which the gas is compressed; B is the cast iron receptacle in which the chlorate of potash used for the production of oxygen is placed; C is a sleeve in which the liquid carbonic acid is volatilized; F is a wooden box containing non-conducting material; D is the liquid carbonic acid reservoir, surrounded by a refrigerating envelope, in which liquid sulphurous acid is volatilized. At H is a non-conducting envelope, G the gasometer for gaseous carbonic acid, K the reservoir for liquid sulphurous acid, P one of the pumps, and A′ the cock which, when opened, allows of the escape of the liquefied gas in the direction of the arrows.

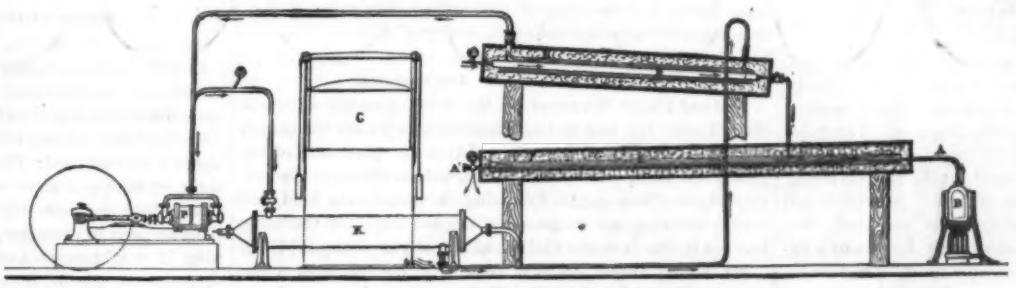


Fig. 2.—PICTET'S APPARATUS.

The process of liquefying oxygen is as follows: The receptacle, B, containing chlorate of potash, is placed over a gas furnace. The gas disengaged from the salt becomes compressed in the long curved iron tube which, as indicated in Fig. 1, is inclosed in the casing, F, and terminates in a manometer. It is surrounded with liquid carbonic acid, which, vaporizing under the influence of the exhausting pumps, produces a degree of cold equivalent to —220° Fah. This carbonic acid is liquefied in a tube contained in the upper box, H, being drawn from the gasometer, G, by the pumps and compressed into the tube. The latter is surrounded by liquid sulphurous acid, which constantly vaporizes. The sulphurous acid reservoir is represented at K, Fig. 1. With the description which we have already given of M. Pictet's process the reader will have no difficulty in understanding all the details of the operation, which simply consists in subjecting the oxygen compressed by chemical decomposition in the tube in F to the intense cold produced by the vaporization of carbonic and sulphurous acids in the tubes in H.

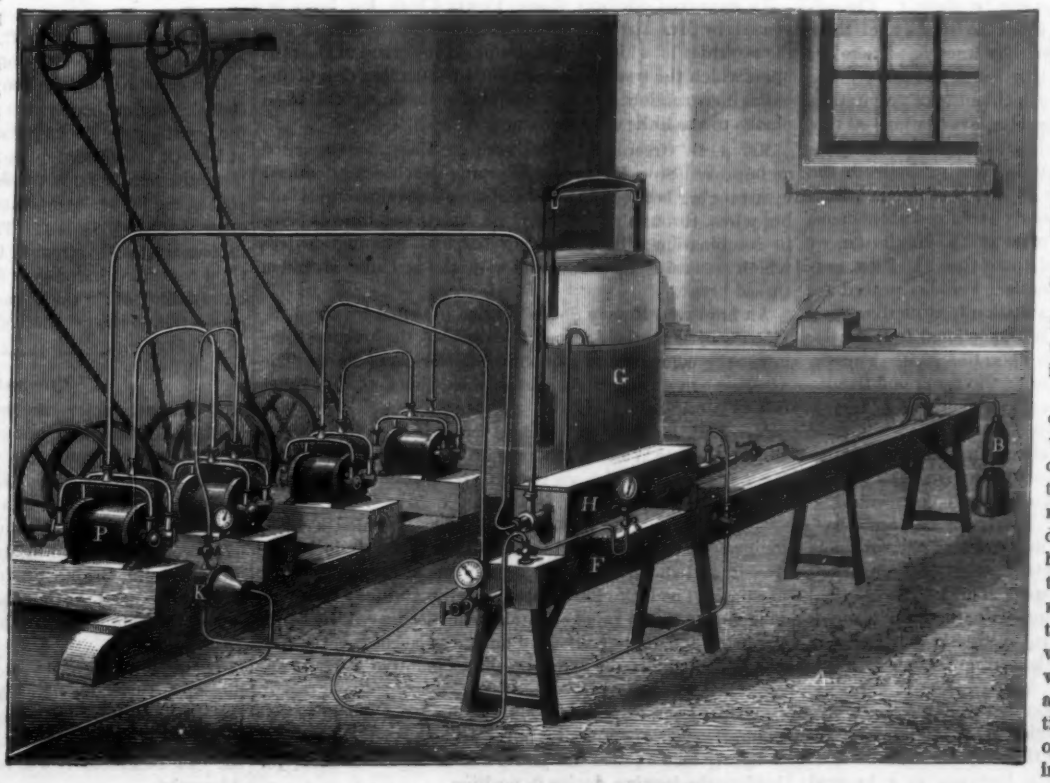


Fig. 1.—PICTET'S APPARATUS.

The Origin of Limestone.

Professor W. C. Williamson has recently contributed a paper to the Manchester Philosophical and Literary Society, in which he describes some interesting observations on this subject. It has long been the opinion of scientists that the great beds of limestone and chalk are made up of the remains of microscopic organisms, chiefly the shells of the foraminifera. These foraminifera consist of a gelatinous looking body, protected by a shelly covering, which is sometimes very complicated in form. Their shells form large deposits now on the sea bottom, and are among the most beautiful of microscopic objects. When present in chalk they may be obtained by scraping with a knife and examining the powder with a microscope.

There are, however, many limestones in which none of their remains are to be seen. Professor Williamson explains this by saying that such limestones have become changed since their deposition by the action of water containing carbonic acid in solution, which dissolves and disintegrates the shells. As a proof that such action has taken place, he describes a slab of limestone in which a large chambered shell was found. The greater part of the slab contained traces of foraminiferal shells, mostly disintegrated and hardly to be distinguished, but within the larger shell these were found in a state of good preservation, as though the remains of the animal which inhabited the larger shell had protected them from the action of the water.

A still more convincing proof of this action is found in the inner chambers of the large shell, which were found to contain clear crystallized limestone. This was undoubtedly formed by the solution of the carbonate of lime in the water, which found its way into these chambers in a saturated condition and there deposited the crystals. Prof. W. adds:

"If these explanations are correct, as I believe them to be, we have here the entire history of the origin of a limestone rock, from the first accumulation of the foraminiferous ooze, as seen in the interior of the first large chamber of the nautilus, to the deposition, in an inorganic mineral form, of the crystallized carbonate of lime within the closed chambers of the nautilus, all being illustrated within the area of a slab of limestone little more than a foot in diameter."

Insect-Eating Plants.

Mr. Francis Darwin has recently added some important facts to our knowledge of these plants. It has long been surmised that those plants which catch and kill insects in various ways depend upon such food for their healthy growth, but direct proof of this has heretofore been wanting.

Mr. Darwin instituted a series of experiments to decide the question, as follows: 200 plants of *Drosera rotundifolia* were cultivated in soup plates filled with moss; each plate was divided into two parts by a low wooden partition and covered with gauze to exclude insects. On one side of each plate the plants were fed with small pieces of roasted meat, placed upon the leaves, every few days, while those on the other side were not allowed any such food. In the course of a month the effect of the meat diet was evident in the brighter color of the leaves, and when the experiment was ended it was found that the plants had received much nourishment from the animal food. While there was a decided gain in every way, the greatest advantage was found by comparing the seeds produced by the different plants. The ratio between the weight of the seeds from those without animal food and those with it was as 100 to 379·7. Any of our readers can arrange to carry out experiments like this which could not fail to be of interest and value.

The Study of Nature.

M. Eugène Viollet-le-Duc, in his recent book, "Mont Blanc," describes the characteristics of his volume thus:

"Our globe is, in fact, only a great edifice, all whose parts are capable of rational explanation; its surface assumes forms dictated by imperious laws, following a logical order.

"To analyze carefully a group of mountains, the manner in which they were formed, and the causes of their ruin; to discover the order in which the phenomena of upheaval occurred, the conditions in virtue of which they have resisted or endured the action of atmospheric agents; to note the chronology of their history—is to devote one's self to a work of methodical analysis which is, on a grander scale, analogous to that which the practical architect and the archæologist applies himself when drawing conclusions from the study of buildings."

Communications.

Color Blindness in Railroad Engineers.

To the Editor of the Scientific American:

In reading your article on the subject as named above, I am reminded that there is a difficulty in some persons in distinguishing colors, arising from the distance of objects. To all persons not absolutely incapable of distinguishing color, distance makes all objects blue. However brilliant may be the green upon a distant mountain, it appears blue to the observer. But how far distant must an object be in order to lose its appropriate color, as we should find it when near at hand, and is that distance the same for all persons? I have reason to believe that it varies with all persons according to their length of sight, so that a lamp on an engine at night that would show red or green to some would appear blue to others, and that engineers should be tested not alone for power of discriminating colors ten feet or ten yards off, but at a half a mile, a mile, or two miles distant also. E. B.

A Question for Locomotive Experts.

To the Editor of the Scientific American:

It is suggested that our locomotives might be made more efficient and serviceable, especially for freight work, by giving them just half their present piston area and doubling the length of their stroke, inasmuch as it would impose but half the strain and friction upon the working parts, while the power would be slightly increased under the same expenditure of steam.

The importance of the subject induces me to send you an outline sketch of a modern locomotive illustrative of the question, and to ask for the opinion of such of your intelligent readers as are posted upon the subject.

The dotted lines indicate the alteration which would be necessary to make the change. It will be seen that the modification would require simply to extend the cylinders forward enough to give the extra length of stroke and to connect with the rear drivers instead of the forward ones; this would give to the connecting rods about the same working angle upon the twenty-four inch cranks as they now have upon the twelve inch ones. The cylinders would, of course, have to be placed a little further apart because the connection must now be made outside instead of inside of the parallel rods.

F. G. WOODWARD.

A Brilliant Meteor.

To the Editor of the Scientific American:

A meteor was observed by the undersigned last Sunday about 7:53 P.M., more brilliant than Venus, moving slowly from the direction of Andromeda southeasterly and passing but a few degrees below Mars towards Canopus. The color of the light was white, and its brilliancy for the space of about 30 degrees observed remained uniform, traversing through that arc in about 3 seconds of time. No visible tail remained, though the sky was very clear and dark, but sparks apparently followed the meteor only for about a degree or two. The sparks denoted an apparently spiral movement.

R. D'HEUREUSE.

New York, February 5, 1878.

The Correlation between Magnetic Electricity and Gravitation.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of February 9, 1878, is given an account of an experiment by which some close connection between electricity and gravitation can be shown. The evidence bearing upon this relation, if not the identity, of these forces is much greater than is generally known. There are many scientific theories supported by fewer and less reliable facts than those which go to prove the identity of gravitation and magnetic electricity. And, besides, gravitation—as this term is understood—is not sufficient to explain all the phenomena dependent upon the relation existing between the heavenly bodies. If gravitation is made to mean something allied to magnetism, some poorly explained phenomena become easily understood. But what are the circumstances affording proof of the identity of these forces? First, gravitation acts upon all kinds of matter; Faraday proved the same of magnetism. Second, gravitation is attractive; so is magnetism. Third, gravitation is proportional to the mass; the force of magnets also depends upon the mass. Fourth, gravitation acts in an inverse ratio to the square of the distance; so does magnetism. Fifth, gravitation does not manifest polarity; magnetism is known not to do so. Sixth, gravitation acts independently of bodies affording a resistance to light and heat; so does magnetism.

But there is positive proof of a magnetic connection between the sun and earth. First: The magnetic needle has a period of the same length as the maximum of the sun spots. Second: The auroras and currents of terrestrial electricity have the same period as the sun spots. Third: The isoclinal, isodynamic (of the magnetic), and isothermal lines run parallel. There is evidence also that magnetic electricity extends to all solar bodies and is the cause of the least understood of their phenomena.

First: Will not the supposition that the sun is a huge magnet account for the production by that body of light, heat, etc.? Second: Admitting this hypothesis, will it not explain why the light of the sun increases as a heavenly body approaches it? Third: Will any other theory explain this satisfactorily? Fourth: No known force except magnetism can produce all the phenomena of comets. It is sufficient to produce the most wonderful and least understood features of these bodies, namely, the dual appearance of Biela's comet, the multiplication and relative position of the tails, and the coruscations of the latter.

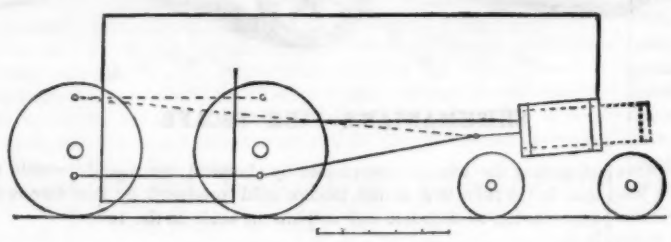
The very best of reasons can be given in support of every position taken or implied in the above statements or questions.

P. M. C.

Circleville, O.

Teasel Parasols.

An entirely new commercial article has quite recently arrived in England from France, in the shape of a curiously twisted stem. This stem, which is flattened and spirally twisted, and marked with deep corrugations or channels, proves to be that of the fuller's teasel (*Dipsacus fullonum*), a plant very much cultivated in Southern France and Austria for the sake of its prickly flower heads, which are so extensively imported into this country for carding or raising the nap on cloth. Hitherto, the only application to which the stems have been put has been for fuel, or for manuring the ground after they have been allowed to rot. Their prest use is for the handles of ladies' sun shades, and when manipulated they have a very grotesque and striking appearance. Several thousands of these fasciated teasel stems are now in England, and are in the hands of Messrs. Marshall & Snelgrove, the well known West End silk mercers, from whose establishment they will issue as a novelty during the coming season. At a recent meeting of the Linnean Society, some of these fasciations were shown as imported, as well as a finished parasol with a teasel handle, sent by the firm who intend bringing them out. At one time these fasciated stems were supposed to be very rare, but from the fact of so many being now introduced they would seem to be of common occurrence.—*Journal of the Society of Arts.*



PROPOSED CHANGE OF STROKE.

New Mechanical Inventions.

A Metal Punch invented by Mr. S. H. Jenkins, of Nashville, Tenn., is a tool of two diameters, in which the punch proper, being the smaller part, drives its piece out of the plate; but just previous to its being driven through, the cutting edges of two spirals following the punch take hold, and with a shearing cut remove the ragged edges of the hole, leaving it, the inventor claims, as smooth as though drilled.

Mr. Henry Hubel, of New York city, has invented a Machine for Crimping Seamless Foxings for boots and shoes, which consists of a fixed crimping block in connection with movable side and front retaining devices and reciprocating adjustable jaws, between which the foxing is held, to be stretched over the crimping block.

Mr. J. K. Miller, of Pleasant Hill, Mo., has patented a Rack which may be adjusted for use as a clothes-horse, a swing, a cot, and various other uses.

An improved Railway Horse Power Chain has been invented by Mr. Martin Williams, of St. Johnsville, N. Y., the novelties of which consist in the arrangement of the rods upon which the track rolls turn, in a connecting link of peculiar construction, and in the mod e of fastening the tread planks to the links of the chain.

Mr. J. B. Greenhalgh, of Uxbridge, Mass., has invented an improved Stop Motion for Warping Machines, produced by arranging between the reel and spools a series of gravitating wires, through eyes formed on which the threads pass, in combination with a vibrating bar and tripping devices which actuate a belt shifter and stop the machine should a thread break.

An improved Rotary Steam Engine invented by Mr. J. S. Hewitt, of Wheatland, Mo., is claimed by the inventor to be unusually compact and economical in the use of steam. The arrangement of the ports, piston disk, buckets, and other details is original.

Mr. J. P. La Grange, of Ashtabula, O., has invented a Rotary Clothes Washer, arranged inside a reservoir, and having water spaces which are covered on the inside of the cylinder by flanges.

Mr. F. J. Hoyt, of New York city, has invented a Lock for Freight Cars, intended to keep them securely locked in transit, and allow them to be readily opened by authorized persons. The lock closes automatically, and may be so arranged that it will resist all attempts to disengage it by hand, requiring a chain to be hooked on the adjacent car, the cars uncoupled and drawn apart by the locomotive. There are other original features.

A Door Lock invented by M. Hjalmar Bergman, of Stockholm, Sweden, consists of a novel device by which the door is tightly held against the jamb, and a segmental bolt for holding the locking device in position.

Mr. James F. Fields, of Greenville, Tenn., has invented an improvement upon that form of Saw Set in which two notched disks are arranged in a framework to gear with each other, so that when the saw blade is passed between them a set is given in opposite directions to the alternate teeth, one disk being adjusted toward the other by means of a movable journal and a set screw. The improvements consist in the means for holding the detachable disks to the frame so that they may be readily removed and replaced by others; in the means for assisting the set screw in holding the disks to their adjustment; and in the application of a file between the disks to level the teeth simultaneously with the setting.

Mr. R. N. Harrison, of Faribault, Minn., has invented an improvement in the class of wire Egg Beaters having the general outline of a tablespoon. The improvement relates to the construction of the bowl of wire, whose ends are bent in such manner as to adapt them to enter the end of the handle, which is formed of a plate of tin of semi-tubular shape.

Herr Gottfried Klotz, of Böhmisch-Kamnitz, Austria, has invented a Skate having the runner pivoted at the heel. The pressure of the foot upon the forward part of the sole plate utilizes the runner as a lever for operating the clamps which secure the skate to the boot or shoe.

A Feather Renovator, lately patented, has a series of radial tubes for heating and drying, and a set of steaming tubes inclosing the heating tubes, and serving the double purpose of distributing the steam and of preventing the feathers from coming in contact with the heating tubes during the process of drying. The whole is inclosed in a revolving zinc cylinder having wooden ends. This apparatus is the invention of Mr. Wm. A. Stewart, of Big Rapids, Mich.

A Punch for Cutting Letters, etc., out of paper, leather, and other material has been invented by Mr. J. A. Hitter, Jr., of St. Martinsville, La. The cutting face is detachable, and acts upon an elastic cushion, the whole tool being of scissors shape.

Mr. Thos. J. Soden, of Brooklyn, N. Y., has invented an Ice Cream Freezer, in which the cylinder containing the cream is revolved, while shaft and blades are stationary. The new feature is a sliding bar having grooved ends, which pass on and off bars attached to the top of the pail. This bar carries the operating mechanism, and is readily secured or detached.

Effect of Heat on Boiler Plate.

Mr. Charles Huston has recently made some interesting experiments on the variation in tensile strength of iron and steel at different temperatures, with the view of throwing light upon the estimation of the value of boiler plate. To measure the temperature of the test piece and maintain it, the following plan was adopted: The breaking point in each sample was made by taking a piece of the plate planed with parallel sides, about one inch wide, and in the middle drilling a hole $\frac{3}{10}$ of an inch in diameter. This hole was then filled with a plug of amalgam of known melting point. Having thus prepared the sample, it was fixed in the testing machine, and a large blow pipe flame applied, covering the whole width of the piece. As soon as the amalgam became semi-solid on the side opposite to that on which the flame was directed, the temperature was kept uniform until the strain was carried to the point of rupture.

A series of experiments gave the following average results: Charcoal boiler plate, made from the pile in the ordinary way, was first tested cold; at 300° C. (572° Fah.) it showed a percentage of gain in tensile strength of 13·93; at 500° C. (932° Fah.), a gain of 18·02 per cent. An exceptionally soft piece of Siemens-Martin steel gained 21·03 per cent at 300° C., and only 17·86 per cent at 500° C. An ordinarily soft crucible steel, such as is used for boilers, gained 8·23 per cent at 300° C. and 7·18 per cent at 500° C. A rather harder specimen of crucible steel, but not quite hard enough to temper, showed a loss of 1·4 per cent at the higher temperature, and a small gain (5·62 per cent) at the 300° C. test. The results thus obtained show an increase in tensile strength in all the samples tested at 300° C., a continued increase at 500° C. in the charcoal piled iron, but a falling off in the Siemens-Martin and crucible steel in proportion to the probable amount of carbon.

Cleopatra's Needle.

A German doctor has made observations on the Luxor obelisk, at Paris, and has come to the conclusion that the monoliths of Egypt decay with rapidity in European climates. The Luxor obelisk shows that within the last twenty-eight years it has suffered a gradual change, due to the atmosphere of Paris. Gradually the red color of the syenite has become duller and lighter: now the obelisk bears a white film of kaolin, the last product of the decay of granite. In thirty-six years the stone has received more damage from the atmosphere of Paris than during as many centuries in Egyptian air.

The injury which the moist climate of England will inflict upon Cleopatra's Needle is likely to be still more rapid; but there is at least the consolation that its incidental injury in London fogs will not be much worse for the stone than the bad treatment it was receiving in its neglected state at Alexandria.

PRACTICAL MECHANISM.

BY JOSHUA ROSE, M.E.

NEW SERIES.

TEETH OF GEAR WHEELS.

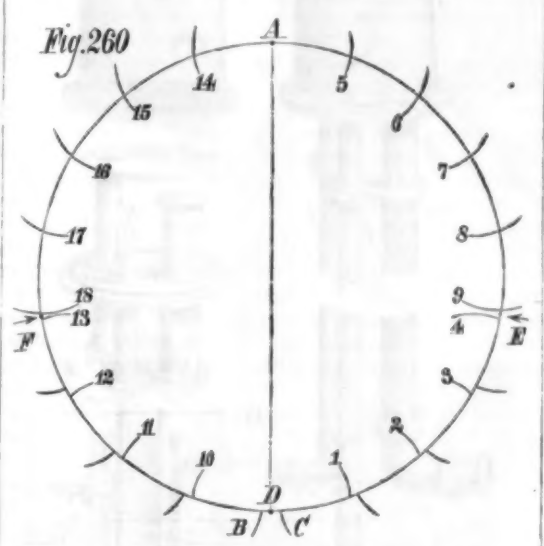
In selecting which of the curves previously described shall be applied in the formation of a wheel or wheels the constructor is governed by the purpose for which the wheel or wheels are to be used, because the conditions will not always admit of the employment of the theoretically most desirable form of tooth. It is perhaps the better plan to first explain the mode of construction of the various forms of teeth, and to subsequently explain the conditions which determine the selection of either form. First, then, for a pair of wheels intended to work together, and not designed to work in gear with any other wheels of a different diameter, teeth having epicycloidal faces and radial flanks are usually conceded to be the most desirable. If, however, wheels require to operate with others having a different number of teeth they are termed interchangeable wheels, and require to have hypocycloidal instead of radial flanks, the faces remaining epicycloidal as before. Both of these forms of teeth are termed epicycloidal, as contradistinguished from involute teeth. Epicycloidal teeth are employed when the distance between the centers of the wheels in gear is permanently fixed, but when this distance is required to vary involute teeth are preferred for reasons which will appear in due time.

On account, however, of the difficulty of constructing epicycloidal teeth for pitches less than about ¾ inch it is the usual practice to apply the involute curve to all pitches of that and less pitch. Small cut gears, both involute and epicycloidal, have indeed been made of late a special manufacture, and from the refinement of construction attending their production under these circumstances they are obtainable in far more perfect form than it would be practicable to make them in the ordinary course of workshop manipulation. Fine pitch gear construction, both as regards the involute and epicycloidal forms of teeth, is indeed so entirely a branch by itself that it must receive separate treatment.

Let us now proceed with the construction of a pair of wheels to work together and not to gear with any other wheels. The distance between the wheel centers being permanent, we select, according to custom, epicycloidal teeth with radial flanks. If then we are given the diameter of the wheel at the pitch circle, and the pitch and number of teeth, we may proceed at once with the practical construction; but it is obvious that the circumference of the pitch circle must be such as will be divisible, without leaving a remainder, by the given pitch, otherwise there would be at one part of the wheel a fraction of a tooth—a construction which is impracticable; so that if the circumstances of the case require a definite circumference of pitch circle, the pitch of the teeth must be made such as will divide into that circumference without leaving a remainder; but if the circumstances compel a definite pitch we must make the pitch circle of a circumference divisible by the pitch without leaving a remainder. If one of two wheels is to be twice as large as the other, one will contain twice as many teeth as the other, hence it is much more simple to gauge the size of the wheel by the number of teeth it contains, and to avoid calculations in the workshop. Most workmen have a printed table containing columns of figures under the following headings, "Number of teeth," "Pitch 1'," "Pitch 2'," etc., "Diameter of wheel," etc., so that a ready selection of pitches or diameters suitable to any given circumstances may be made; or, finding none to exactly suit the requirements, we may select the nearest, varying either the pitch or diameter as may be most suitable. It will generally be found that the pitch diameters of wheels for certain pitches and numbers of teeth run to two or three places of decimals, and that these decimals are not convertible into such fractions of an inch as are marked on ordinary measuring rules. This, where accuracy is required (and accuracy is invaluable in gear work), has been a serious drawback in the practical operations of the workshop. The special steel gear rules of Brown & Sharpe are therefore a boon to careful workmen. These rules are marked in fine clean lines to various fractions of an inch, as 6, 7, 8, 9, 10, etc., up to 38ths, enabling the setting of the compasses to correct radius as well as their ready adjustment to chord pitch.

The diameter at the pitch circle and the pitch and number of teeth being determined, we have to find the proper addition to make to the radius of the pitch circle for the points of the teeth, and this addition is termed the addendum or "depth beyond the pitch line," as marked in the wheel scale. The proportions in that scale are those given by Professor Willis, which proportions are now almost universally accepted, except it be in so far as regards the question of clearance, which we will leave for future consideration. Referring to that scale, then, we add to the diameter of our pitch circle an amount equal to twice the "depth beyond pitch line" given, for the selected pitch, on the scale, and we have the total or extreme diameter to which the wheel must be turned, and while the wheel is in the lathe we must strike a fine circle, of correct diameter, to serve as the pitch circle. Our next duty is to divide off the wheel at the pitch circle into as many divisions as there are to be teeth in the wheel, and in the case of the larger wheels this is no easy task, because the pitch given so far is the arc pitch, and we have to convert it into chord pitch. This we may do by the construction given in Fig. 258; but even by that construction it is impracticable to set the compasses to the exact proper distance, because an error of half the thickness of a line will be multiplied on going around the wheel by as many times as the pitch is contained in the circumference of the pitch circle, so that in a hundred teeth the error would amount to the thickness of fifty lines, and as all this error would fall upon the last tooth it would be too great to be admissible. By the construction shown in that figure we may set the compasses so near as to save spacing over the wheel two or three times, and this is a great assistance; and since it is impracticable to set the compasses so finely as to space off the wheel to positive mathematical accuracy, we can only adopt a method that will be practically correct and that will divide whatever

Fig. 260



error there may be between a number of teeth, and this may be done as follows: Commencing (for a wheel having an even number of teeth) at any point, A, upon the circle, Fig. 260, we mark off on the left and outside of the circle as many divisions as equal in number one half of the required number of teeth, the last division so made being denoted in the figure by B. Commencing again at A, we mark off the same number of divisions on the other outside of the circle, arriving at C, and midway between B and C on the circle we mark a point, D; and no matter whether the compasses were set correctly or not, D will be exactly diametrically opposite to A. It may occur to the reader that D may be more readily obtained by a straight edge intersecting A and B and carried across to D; but the process as here carried out shows us that the compasses are set too close together to an amount equal to the one eighteenth part of the distance between C and D at the pitch circle, hence we may oilstone the compasses with a slip of stone applied to both points on the inside so as to correct them.

Meantime the wheel having an even number of teeth, A and D are two correctly marked divisions. With our compasses corrected to the best of our judgment we proceed to obtain two more correct divisions as follows: Starting at D, we mark within the circle the lines 1, 2, 3, 4, and then starting from A we mark the lines 5, 6, 7, 8, and 9, and the center between the lines 4 and 9 is another correct division, and if the lines exactly meet at the circle the compasses are

Fig. 261.

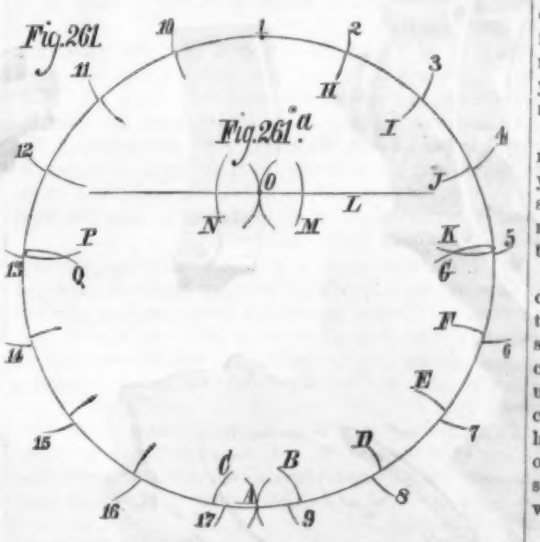


Fig. 261 a.

correctly set; but if not, we may oilstone the points again. Here it is to be noted that in the divisions marked to obtain our first point, D, the marks were all made outside the circle, and all short and of about equal length, while the divisions to obtain our second point, E, were marked within the circle; the object of this is to keep the lines distinct and thus insure greater accuracy. On small wheels it is sometimes advisable to step the points of the compasses around to set them approximately correct without drawing any lines, the object being to avoid having a confusion of lines. Starting again from D, we mark the lines from 10 to 13 inclusive, and starting from A we mark those from 14 to 18 inclusive, obtaining the point F correctly. Continuing this process between A and E, E and D, D and F, and F and A, we may step or divide off the wheel more accurately than is possible by any other means with compasses, and the error, whatever it may be, will be too fine in itself and too widely distributed to be found by any ordinary workshop measurement. If, however, the number of teeth in the wheel is an odd instead of an even one the process requires to be slightly varied, as follows: Setting the compasses as near as possible by the method shown in Fig. 258, we start from any point, 1, Fig. 261, and step off the divisions from 2 to 9, and then commencing again at 1 the divisions from 10 to 17, and the error of the set of the compasses will be shown in the difference between the distance between 17 and 9 and the set of the compasses, and since there are 17 divisions in the circle the compasses require altering to the one seventeenth part of the difference. This being done as nearly as the judgment can determine, we find the center between 9 and 17, which must be done with another pair of compasses, because it is impracticable to reset the pair first used as true as the construction has enabled us to do. We then draw a straight line, L, Fig. 261 *a*, and with the first pair of compasses, with one point resting on the line and used as a center, we mark a section of circle, M. Then resting the other compass point upon the intersection of M and L, we draw the section of circle, N, and from M to N will be the length of each division. Taking the second pair of compasses, we find on the line L the center between M and N, producing the point O. Adjusting these compasses so that, one point resting upon O, the other exactly coincides with M and N respectively, we, with these compasses, rest one point in the center, A, and mark on the inside of the circle the lines B and C, and the distance between C and B will be that of the first and adjusted pair of compasses. Then starting from B we mark on the inside of the circle the divisions, the lines D, E, F, and G, and then commencing at the point 1 we mark also inside the circle the divisions H, I, J, K, and equidistant between K and G on the circle we obtain another of our permanent and correct points of divisions. This process we carry out on the other side of the circle, beginning first at C and then at 1, producing another permanent division equidistant between P and Q at the circle. We have thus obtained five accurate points of division, represented by the points 1, C, B, K G, and P Q, on the pitch circle, and continuing the process from those points we may obtain all the others, and thus obtain an accuracy that would be unobtainable by stepping entirely around the circle.

Useful Notes for Watchmakers.

We find the following in a recent number of the *Watchmaker:*

Main Springs.—When a main spring is cleaned most inexperienced workmen will take hold of one end and pull the spring about half its length straight out, to save time. This practice will break springs when nothing else will; and springs treated thus generally break after the watch has been delivered to the customer only a few days. Breaking into many pieces is owing to the acid in the oil which is used. We will suppose the main spring is a fine one, and has been evenly tempered and properly cleaned; if, now, old oil is used, or that of an inferior quality if fresh, the acid it contains will eat into the spring, and will finally destroy its texture. The coil nearest the center breaks first, and as it recoils it breaks every coil in the barrel, and sometimes each coil is broken twice. The spring has become so impregnated with acid that it has no life left.

To Purify Oil.—To make the oil pure, take a good sized bullet or other piece of lead which has a thick coating of lead rust, cut it up fine, put it into the oil, and let it stand for two weeks. This causes the acid to settle, and it then resembles milk at the bottom. Now pour off the top, and your oil is pure. Common clock oil can be treated in this manner and made better than some watch oil.

To Restore Luster.—If not too much darkened it may be restored by dipping the wheel in pure muriatic acid. Test your acid by dipping a piece of polished steel in it; if it destroys the polish, reduce the acid with rain water until it will not. Rinse the wheels well in water. This will also restore the polish to steel that has been blued by heat.

Grinding Glasses.—Provide two pieces of cork, one concave and one convex (which may be cut to shape after fitting to lathe). Take a copper cent or other suitable article and soft solder a screw to fit the lathe and then wax it to the cork; then get a twenty-five cent emery wheel, such as is used on sewing machines, and you have a complete outfit for cutting your watch glasses. Polish the edge on the zinc collar of the emery wheel, or use a piece of zinc to do it. The other cork should be waxed to a penny and centered. The spectacle lenses may be cut on the same emery wheel, if the wheel is attached to the lathe so as to revolve.

Another method is to take a common piece of window glass (green glass is the best) and make a grindstone of that, using the flat surface to grind on. Cement it on a large chuck, the glass being from 2 to 2·5 inches in diameter.

Any one not familiar with this method would be surprised to see how fast the glass is cut away, for either spectacles or watches. In grinding watch glasses put them flat on the chuck glass—not on the edge.

Some watchmakers are excusable for not keeping a full supply of watch glasses on hand all the time, when it is remembered that there are over four thousand different sizes.

THE price of nickel made a remarkable series of drops during the year lately finished, and is now below its old figure before the German Government upset the market by selecting it for its token coinage. In January, 1877, it was worth $2·64 per lb., and in January, 1878, only 96 cents.

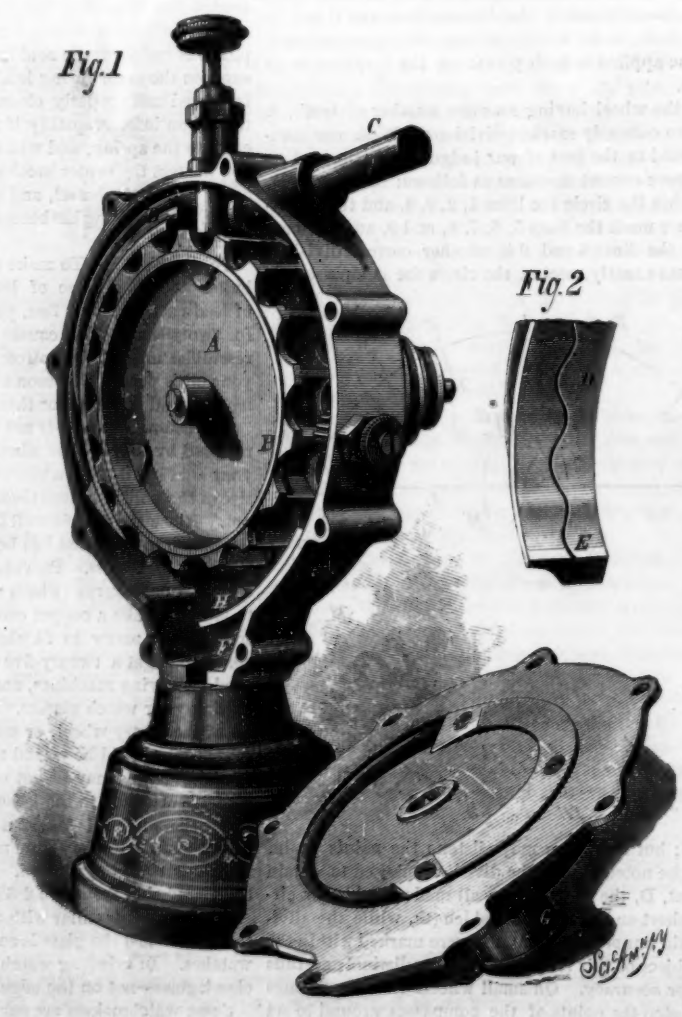
TALLEY'S HYDRAULIC ENGINE.

The annexed engravings represent a new water motor, the smaller sizes of which are adapted for running light elevators, lathes, printing presses, blowers, sewing machines, organs, coffee roasters, spinning mills, sausage mills, etc., or for use in hotels, laundries, forges, in any locality where either high or low pressure water power is had. The device is used either as an overshot or turbine wheel, as may be desired. The larger sizes are fully adapted to all purposes where heavier power is required. The construction, which is quite simple, embodies the casing in which the wheel works, the wheel, wave line chutes, and the gauge. The casing is made of any desired metal, and requires no finishing except where the two sides are joined. The wheel is made of brass or iron cast in halves, and bolted. The shaft runs in bearings in one part of the casing, and on a steel center screw in a bearing in the other part. The chutes are of brass, and are constructed in halves so that they may be opened and cleaned as desired. They have a fine polish so as to give an even sheet or perfect wave of water. On one half of the wave line piece is the valve, which is simply a small tube, in which, on one side, is the inlet, and on the opposite side the three discharge holes leading to the wave line chutes. The upper end is provided with a piston, which opens or closes the tubes as desired for one, two, three, or more ducts entering the wave line chute. In the five-inch iron wheel which we illustrate, there are three distinct ducts, which are opened by the gauge or regulating valve described, either singly, in pairs, or together, as greater or less speed and power are required.

Referring to the illustration, it will be observed that the wheel, A, has peripheral flanges, between which are placed the buckets. The latter are set sloping at an angle of about 30° with the radial lines of the wheel, and between each pair the flanges are scalloped out as shown, being scalloped to afford proper outlet when running as turbine. On the face of the wheel are formed annular flanges, B, which bear against the inner faces of the casing, preventing side play of the water. The wheel is placed eccentrically in the casing so as to touch or nearly touch the latter on the inlet side and to leave a large water way on the outlet side. The induction pipe, C, terminates on the inner face of the casing in a wave line chute, D, shown separately in Figs. 2 and 3. The width of this aperture is greatest at E, where the stream is first discharged upon the wheel, and from that point it gradually diminishes as shown, having greatest weight of water at E, at the other (on the blow pipe principle) the greatest force. The distance over which this diminution takes place may be varied so as to deliver the water upon one or more buckets of the wheel. Preferably the entire length of the chute will coincide with about one third of the periphery of the wheel. By forming the outlet apertures as described the water will be better distributed over the width of the wheel, and by prolonging its length as noted the water will be made to impinge upon the entire working side of the wheel, or a large portion of it, and no dead water carried up or offering any obstruction, so that the power and weight of the fluid are caused to act together and the entire force utilized. Two outlets are provided for the escape of the spent water. The first of these, at F, is used to discharge the water from the casing at the bottom when the machine is used in a vertical position. The other is formed on the side which becomes the bottom when the machine is placed horizontally or in turbine position. A screw cap, G, is placed upon either outlet when not in use. A slide or gate, H, is arranged in the casing so as to close the orifice, F, when not in use. This is operated by a rack and pinion, the latter turned by the screw shown, and does not present any obstruction to the smooth flow of water past that point when the machine is used with the other outlet or as a turbine.

By the wave line chute the water is given in one continuous sheet and not by periodical jets. The working side of the wheel thus becomes a lever, and there is no waste until the outlet is reached.

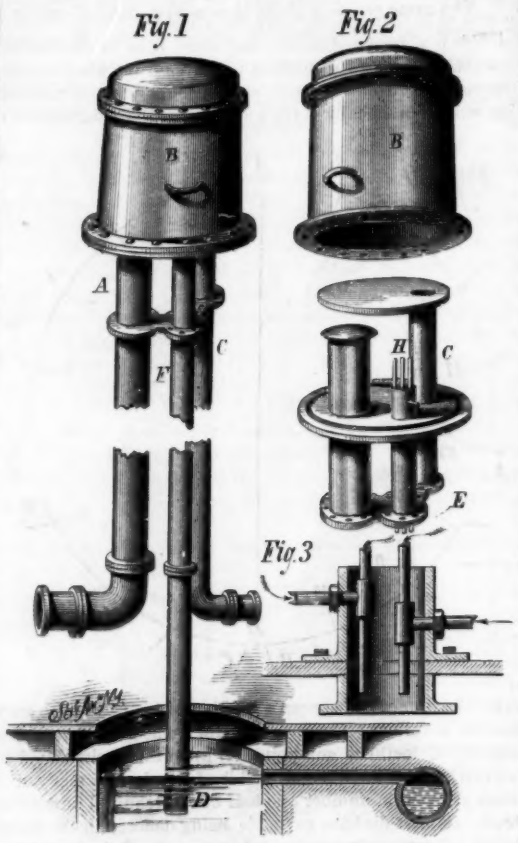
A tapering duct, I, is formed on the side piece, and gradually widens to a point diametrically opposite that where the width of said duct is about equal to the diameter of the orifice, G. From the large end of this duct there is a passage to the discharge outlet, which passage is so formed as to relieve the wheel from back pressure of spent water. The inventor states that he has not sacrificed power to speed, and evidences and claims that this 5-inch engine from which we make our illustration, with 70 lbs. pressure of water and less than $\frac{1}{16}$ inch inlet, has driven a one half horse power 14 inch Fitchburg (Mass.) lathe for metal turning and boring. Engines can be seen in operation at the machine works of C. B. Maedel & Co., Kansas City, Mo., to whom all orders for engines of any size, from 2 inch upward, should be addressed. Patented October 16, 1877. For further information as to price, rights to manufacture in other States than Missouri, etc., address the inventor, Mr. James Talley, Jr., Kansas City, Mo.



TALLEY'S HYDRAULIC ENGINE.

THE RANSOM SIPHON CONDENSER.

Until within a few years the air pump has been the only instrument capable of forming a vacuum of high range in a steam condenser, and while almost numberless attempts to improve it have been made, it practically remains as it left the hands of Watt a century ago. Among the notable attempts to supersede its use is the condenser and apparatus illustrated herewith, which was invented and perfected by Doctor Frank Ransom, of Buffalo, Erie county, New York, after a study and labor extending over a period of twenty-five years. We are informed that this condenser is now in successful use, maintaining a vacuum of high range on nearly one hundred steam engines, vacuum pans, etc. The Ransom siphon condenser, as its name indicates, is operated by the use of a siphon, by which the water for condensation is elevated to such a height as that, having been discharged into the condenser in contact with steam, it will flow from it; and while maintaining vacuum of high range, will overbalance the atmospheric pressure upon the surface of the water in the hot well, and flow out as fast as received. It is well known that all siphons operated continuously will collect air at their crown or highest point, which accumulation of air, from the water as it passes, will finally cut off and stop the flow of the current. Dr. Ransom discovered that, by a proper disposition of his delivery or outflow pipes, this defect in the natural operation of a siphon could be overcome by so arranging his pipes that water would mingle with the air, and abstract it from the crown of the siphon. He also found that he could enlarge the crown of the siphon, divide the current of water, and yet maintain its flow; and, finally, that he could condense steam from an engine or vacuum pan, and eliminate the air brought in by leaks in the apparatus by the outflowing current. If it were practicable to make work of this description absolutely tight, so that no air could enter, a siphon with 2 or 3 feet head would operate; but as that cannot be done, a head or difference in the two legs of the siphon of 10 to 15 feet is used, and where no head or fall is available, a common water pump is required. Referring to the engravings it will be seen that this condenser is simple in construction, that there are no valves or moving parts to be refitted or to get out of order, and that the apparatus is an assemblage of pipes forming a siphon with an enlarged crown. Its durability is also evident, and it can be placed in any position outside of the mill, wherever most convenient. It requires no especial skill or knowledge to operate it, as there are no injection cocks to attend to, and in fact it is claimed to add nothing to the ordinary care of a high pressure engine. The amount of power required is stated to be only that necessary to keep the siphon running. Thus, at starting, the pump will have to lift the water the full height of the condenser, but as the vacuum increases, the labor on the pump diminishes. Thus, if the condenser is 34 feet above the hot well, and vacuum at 26 inches mercury (the usual range), the siphon would lift the water 29 feet nearly, reducing the labor on the pump to a lift of 5 feet. When a head or fall of water of 15 feet can be had no pump is required, and the vacuum can be maintained indefinitely. Should a steam pump be used, it can exhaust also in the condenser, and acts as an independent motor, leaving the total value of the vacuum net to the engine. In this case the vacuum may be formed before the main engine is started, which is often of great value on large engines. Extensive use at the West has demonstrated the application of this condenser in gritty water, where an air pump could not be used. Speed of the engine attached to condenser is no objection, as under proper construction, we are informed, the vacuum will be steady at any speed, and heating of condenser cannot occur, as the water must pass through constantly. It has been adapted successfully to lake and river steamers, to vacuum pans for sugar, dyestuff, etc., and is applicable to all purposes where a vacuum can be used.



THE RANSOM SIPHON CONDENSER.

In the annexed engravings, A is the exhaust from engine or pan; B is the condenser; C, the water injection pipe attached to an ordinary water pump or to water works, or other head of water; D is the overflow and hot well, from which the feed water may be taken on its passage to feed water heater and boiler. At E are small delivery pipes contained with-

in the large delivery, F, and running from inside condenser to the hot well. These small pipes take water at or near the floor of the condenser through horizontal pipes tapped into the delivery pipe (see Fig. 3, arrows, page 150), and take air at their upper ends. They discharge air and water mingled at bottom of delivery pipe in hot well. In operation the exhaust steam passes through pipe, A, into condenser, and expands under the spray plate, when it comes into contact with a spray of water from the pump or other source of supply through C. As the steam is condensed, its water and the water of injection, heated to about 100°, fall to the floor and accumulate to the height of the mouth of the small pipes, thus filling them with water; as this water rushes downward it creates a vacuum, which causes the air to pass down the small pipes, and thus the air is drawn from the condenser. As the water overflows the top of the large delivery pipe, it passes out and prevents any further accumulation of water. Thus the large delivery operates as a safeguard against flooding. These delivery pipes all carry out water mingled with air, and it has been found that the vacuum will be maintained by the outflow of the water necessary for the condensation of the steam used.

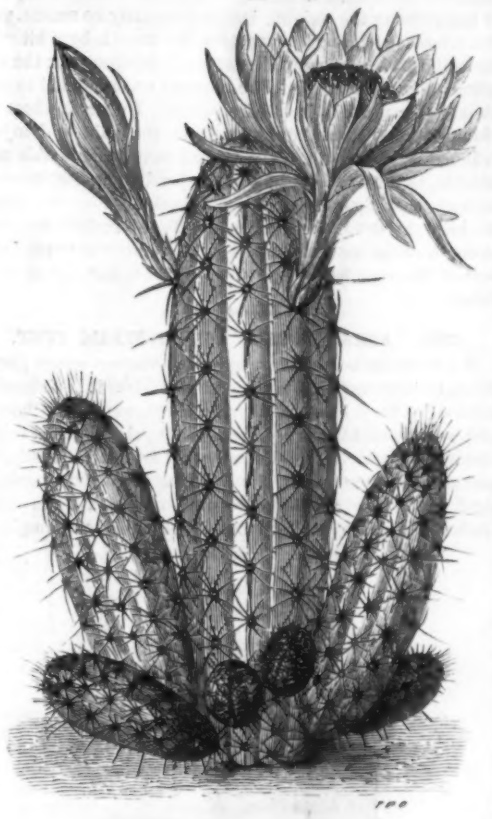
The object of a vacuum as applied to engines is to take away the atmospheric pressure or resistance from the exhaust pipe at its discharge, and through it from the moving piston. If we have 26 inches vacuum with this condenser we can safely count 24 inches or 12 lbs. per square inch as net gain to the engine. This has been found to amount to a gain of from 25 to 40 per cent, which can be utilized either in so much additional work done, or by saving that amount of fuel as compared to the engine when running without condenser. It has also been found that lower steam can be used to do the same work, 50 lbs. steam on the boiler and condenser doing as much work as 75 lbs. without it. The invention is secured by several letters patent, now the property of the Ransom Siphon Condenser Company, J. L. Alberger, Treas., Buffalo, N. Y., to whom, or to T. Sault, General Agent, New Haven, Conn., communications may be addressed.

2,000 Miles in 1,000 Hours.

The unprecedented feat of walking 2,000 miles in 1,000 consecutive hours was brought to a successful conclusion in Dublin, Ireland, February 5th, by W. H. Smythe, the "American postman." For forty-two days and nights Smythe had walked continuously, making one mile at least every hour. The last mile was walked in 8·5 minutes, and sixty-five miles were made during the last twenty-four hours. Gale's Lilliebridge performance of 1,500 miles in 1,000 hours was the greatest previously recorded. At the completion of his task Smythe's physical condition was reported by his medical attendants to be as good as when he began it. Such exhibitions of physical endurance have in themselves very little to commend them; still they are not without scientific value as evidence of human capacity and as proofs that the race is not deteriorating to any alarming extent.

THE CEREUS CANDICANS.

The name cereus is given to several species of cactus, the largest and most remarkable of which is the *Cereus giganteus*



THE CEREUS CANDICANS.

of New Mexico, while the night blooming cereus (*Cactus grandiflorus*) is a familiar and beautiful example. The *Cereus candicans*, shown in our illustration, is also a prominent member of the family. Its growth is vigorous, the stem when five feet high attaining a girth of three feet, and as the angles are large and shallow, the plant has an extremely solid and substantial appearance. The spines, which are in sets of from twelve to twenty, are from two to four inches long and very acute. The flowers are pure white, and but sparingly produced. The *Cereus candicans* may be increased from offshoots, which it throws out freely at the base, and adapts itself to a great variety of soils.

BLACK COCK AND PTARMIGAN.

The black cock or black grouse is a highly prized game bird, indigenous to the northern parts of Europe and especially to the wild and wooded districts of Scotland. The plumage is of a steel blue color, the breasts and sides being brownish black. The weight of the male often reaches four pounds; that of the female is about two. The favorite abode of the bird is in the highlands and glens, among the hills clothed with a luxuriant growth of birch, hazel, willow, and alder, with an undergrowth of deep fern. Their food consists of tender twigs, berries, heaths, and occasionally seeds from the stubble fields. Their flight is heavy, straight, of moderate velocity, and capable of being protracted. The black cocks are polygamous and fight desperately for the females during April. The eggs are from six to ten in number, of a dirty white color, with rusty spots, and are laid in a very rude nest on the ground.

The ptarmigan, which is represented both in summer and winter plumage on the right of our engraving, is also a member of the grouse family, but differs from the ordinary grouse in having the legs feathered to the claws, giving somewhat the appearance of a hare's foot (whence the generic name from the Greek); in the truncated tail, about two thirds as long as the wings and of sixteen to eighteen feathers; in most of the species becoming white in winter, and in the nasal groove being densely clothed with feathers. There are six or eight species described, inhabiting the northern and snow covered regions of both hemispheres, being one of the few genera characteristic of the Arctic fauna; they are as much at home in snow as are the web footed birds in water, and their plumed feet enable them to run over its surface without sinking. The species represented in the illustration is the common European ptarmigan. The bill is black, short, and robust; the summer plumage is ashy brown mottled with darker spots, and barred with orange yellow and dark brown on the sides of the neck and back, and the tail with the exception of the two middle feathers is grayish white with a narrow terminal white band. The bird is fond of lofty and northern regions, going as far as Greenland, and coming down to the highlands of Scotland. When pursued, it is apt to dive under the soft snow. It sometimes does this for protection from the cold, and in damp weather is often imprisoned under the frozen surface.

BLACK COCK AND PTARMIGAN.

Microscopical Notes.

The *American Journal of Microscopy* for February contains several articles treating from distinct points of view the expediency of increasing the power of object glasses beyond the limit usually assigned to them.

One method of obtaining this result is the employment of deep eye pieces, and as Professor R. Hitchcock recently condemned their use, the question has been taken up by one who holds a contrary opinion. The observation that has drawn attention to the subject was made by Professor Hitchcock in a letter to Professor J. E. Smith on the question of "Low versus High Power Objectives."

The remark was as follows: "I fail to see the advantage of working a glass up to its fullest capacity with deep eye pieces. It is trying to any glass, and it is questionable if it is an advantage to use an inch objective to see 30,000 lines to an inch with deep eye piece. I dare say few workers will be induced to follow this plan; in fact, few one inch objectives would stand it."

Professor George E. Blackham, of Dunkirk, writes to the *Journal*, objecting to this statement.

He says: "I believe in using first-class wide angled lenses, of comparatively low amplifying power, and getting the increase of power by the use of deep eye pieces, rather than using only low eye pieces and obtaining gradations of power by the use of low priced narrow angled penetrating objectives. 1st. Because I get better results. 2d. Because it is a more simple and therefore more rapid and convenient way to work. 3d. Because it is more economical.

An illustration of this is given: "Lieutenant Carpenter made an admirable dissection of a frog poisoned with curare, and exhibited the circulation of the blood in the capillaries of the mesentery. For the exhibition of this interesting object (which is certainly physiological, histological, and pathological enough to placate the most rabid anti-diatomaniac that ever worked with a French commercial triplet), I selected my Tolles one inch objective of 30° aperture, and obtained amplification of 100, 200, and 400 diameters by simply changing the eye piece. Now even with the ¼ inch solid eye piece, giving an amplification of 400 diameters, the view of the object was satisfactory, and I had a clear working distance of ·317 of an inch."

In regard to this matter it appears that there is much practical usefulness in both of the systems here advocated, and that the chief evil will be found in carrying either practice to extremes.

Much depends on the nature of the work in hand, and it is upon these technicalities of manipulation that the skill and judgment of a good microscopist are shown. In fact, both these methods are usually employed in conjunction. A microscopist failing to observe something with a ¼ inch objective and an A eye piece, will probably change his eye piece for a B or C, and having observed the structure he is in search of, he will return his low eye piece and use an objective of a higher power, so as to obtain an improved light and better definition.

The next method noticed is the use of "an amplifier." Attention is directed to this piece of accessory apparatus by Dr. Gustavus Devron, of New Orleans, who writes to the same journal describing an amplifier made by Tolles.

Here is a system of increasing the power of the object glass by placing a lens between the object glass and the eye piece.

This apparently simple plan of increasing the power of object glasses entails many difficulties, which opticians have for years endeavored to overcome; if Mr. Tolles has succeeded he has conferred a great boon on microscopists.

Dr. Devron writes a very fervid appeal in favor of this amplifier of Mr. Tolles, and states its merit to be as follows: "Its cost is but little more than that of an ordinary eye piece, and as it may be used with every eye piece, its possession is equal to having twice as many such glasses, and the possessor of a good modern objective of moderate power can accomplish with it almost anything that would require an objective of the same grade and of double magnifying power; thus a $\frac{1}{7}$th with an amplifier will do the same work that a $\frac{1}{15}$th would without the amplifier."

This is indeed tempting, and the news appears to be too good to be true. Dr. Devron says every microscopist should have a "Tolles" amplifier. Let the foregoing description be confirmed, and doubtless every microscopist will purchase one, but the same piece of accessory apparatus has hitherto failed, which would make a prudent reserve pardonable on this occasion.

Any subscriber who can confirm Dr. Devron's views is invited to forward his experience of the new amplifier. Lastly, Dr. Francis Gerry Fairfield, Professor of Microscopy and Micro-Chemistry, New York College of Veterinary Surgeons, writes to the *Medical Record* a letter describing without intelligible details a means of increasing the power of an objective from 1,500 diameters to 7,500 diameters. He says, with this modification, an investigator with a good ⅛ inch objective can obtain the same results as with a $\frac{1}{25}$ inch. The means employed are barely hinted at, and cannot therefore be here furnished. The *Journal of Microscopy* reproduces this letter under the heading of "Humorous," and the lines,

> "A little nonsense now and then
> Is relished by the wisest men,"

thus, as it were, placing the Doctor in the "pillory" of ridicule. As no particulars are given it is not easy to perceive how any opinion can be formed, unless the Doctor's critics believe that the assertion that an enlargement of 7,500 diameters was obtained with a $\frac{1}{10}$ objective indicated mental derangement.

It is to be regretted that the great aim of microscopy is sometimes overlooked, and that the indefinite enlargement of the image, rather than the perfect definition of the object, should be accepted as indicating successful work.

Bearing Reins.

The ligamentum nuchæ of a quadruped, as is well known, supports the head, and in health relieves muscular tension in maintaining the weight; but that is surely no reason, says the *Lancet*, why a rein connecting the mouth by a bit with the collar which bears on the cervical vertebræ, near the vertebral prominences, should be imposed on the animal to supplement the provision made by nature. Under the best of circumstances, casting out of account the pain and injury inflicted on the mouth of the animal, the effect of this rein must be to throw the weight of the head upon the muscles instead of the ligaments. If from weakness the horse allows its head to drop, the aim should be to restore the vital strength of the natural support, not to place the burden on a part of the organism which the ligament was intended to relieve.

THE "ACME" DOUBLE ACTING STEAM PUMP.

We illustrate herewith a simple and compact steam pump, strongly constructed, and the cost of which, it is claimed, is reduced to the minimum amount consistent with efficiency and good workmanship. A simple D valve is used in the steam chest, which is a cylinder cast in the bend of the frame, and at its weakest point, thus making the frame perfectly rigid under the heaviest pressures required. The crank shaft runs in Babbitt lined boxes, which have a simple arrangement for taking up the wear. Other arrangements are provided for taking up all the wear in every part of the pump. The manufacturers, who are also the manufacturers of the Wright Bucket Plunger Steam Pumps, state that one of these pumps has been successfully running since March, 1876, under difficult conditions and with uniform success. For further particulars address Valley Machine Company, Easthampton, Mass.

THE "ACME" PUMP.

New Agricultural Inventions.

An improved Churn, the invention of Mr. W. W. Primm, of Murphysborough, Ill., has a dasher made of a hollow center staff and a perforated dash plate extending spirally around the staff. There is a hinged radial gate at the upper edge of the spiral dasher, which opens during the upward motion of the dasher and closes as the latter descends, thus forcing the cream through the perforations.

A Butter Shaper, patented by Messrs. W. H. & Theo. Dulaney, of Peterstown, W. Va., consists of a circular band with overlapping ends, which is set in a ring-shaped former. When the butter is filled in, the band is secured in position by a galvanized iron wire. The band enables the butter to retain its shape during transportation.

Mr. Matthew Moore, of Whippany, N. J., has invented an improved Powder Duster for Destroying Insects, consisting of a rod having a metal shank or standard at its lower end, arranged at such an angle that when the rod is supported in an inclined position by means of a strap passing around the shoulder, the standard is vertical; in combination with a horizontally oscillating receptacle having a perforated bottom, an agitator within, and a lever and connecting rod for parting motion.

An improved Harvester Cut-off has been recently patented by Messrs. A. L. & E. C. Long, of Big Rock, Ill. It is an attachment applicable to the Marsh and similar harvesters, and consists of the combination, with a harvester elevator, of an inclined board, curved spring wires, a cord and treadle, with the seat board of the harvester, for cutting off or separating the grain while a gavel is being removed from the trough, thus preventing the grain from being scattered, and enabling the binders to form neat and compact bundles.

A new Bale Tie, patented by Messrs. T. A. Andrews and A. G. Edwards, of Gainesville, Texas, is made with a buckle frame having a wedge-shaped catch on the end bar, which catch is secured in slots made at intervals in the bale band.

Mr. E. C. Budd, of Prairie Green, Ill., has invented a Sulky Plow, so constructed that one wheel will run in the furrow and the other on the unplowed land. By means of hand levers the driver is enabled to raise or depress either side of the frame of the machine, making it level under varying circumstances. The draught is direct from the plow beam.

Mr. Louis Anthoine, of Epworth, Iowa, has invented a Cultivator, in which the points covered by letters patent are the combination, with the cross bar of the frame, of a plow beam, connected to it by a U bar, lug pivot, and offsetted bar. The plow beam is raised and lowered by a lever and ratchet. The machine is adapted for use with a driver, or as a walking cultivator, being provided with handles for use in the latter case.

A Plow, invented by Mr. Asa Newsom, of Valdosta, Ga., is set to any required pitch by means of a screw and two pairs of nuts, one end of the screw being fixed in the plow standard, and the other working through parts secured to the beam.

Mr. John Burkholder, of Centerburg, Ohio, has invented a Wheat Steaming Apparatus, which consists in a double conical-ended cylinder, which contains an interior slitted and perforated vessel. The grain is fed through a valve at the top, and passes between the outer and inner shells, being steamed in its progress downward. As the perforations of the interior vessel do not extend to the bottom, the lower part of the apparatus is kept dry by removing the condensed steam, and the grain is delivered from the lower exit in condition for grinding.

A new Cultivating Implement, patented by Mr. W. H. Thomas, of Way Cross, Ga., combines the advantages of a common hoe, finger hoe, rake, driller, etc. It has interchangeable parts, attachable to the same handle, one of which has cultivator teeth and a drilling tooth, and also a rake and hoe.

Mr. Wm. R. Fowler, of Baltimore, Md., has invented an Attachment for Plows which is in the nature of combined rake and scraper, or leveler for the upturned furrow slice. The device consists, generally stated, of a curved arm or bar hinged to the plow beam by detachable and adjustable clamps, and carrying a rake and scraper. The rake tears the furrow slice, and the scraper smooths or levels it.

An improved Planter and Drill, invented by Messrs. S. J. & C. Weickel, of Laclede, Mo., has a seed covering shovel following in the rear of each hinged drill tooth, the shovel being attached to the tooth by means of a rod which is bolted to the tooth. The shovel is concave on the edge, to cause it to cover the grain and leave a narrow ditch on each side for the water to run off in. The drill spouts have side flanges and slide in guides under the drill box.

A patent recently issued to Mr. James Tripp, of Coldwater, Mich, covers a number of improvements upon that form of Cotton Picker in which a set of pendent pickers, composed of bars surrounded by upwardly pointing teeth, is arranged to revolve, and in the revolution to descend into the cotton bush and seize the fiber, and then, with a motion to the rear to compensate for the progressive movement of the device, to ascend and deliver the fiber to a set of strippers. The invention consists chiefly in the construction of pickers, and the arrangement of the sets of the same upon revolving reel arms for a continuous and better action.

Recent Analyses of Furnace Gases.

M. Cailletet has published in a recent number of *Comptes Rendus* an interesting article detailing the results obtained by him from analyzing the gases circulating in the hottest parts of the furnaces in which iron is worked. These differ from those previously obtained by Ebelman, who being unacquainted with the phenomena of dissociation did not take into consideration the influence towards recombination presented by the cooling of the gases.

M. Cailletet's analysis is as follows:

Oxygen	13·15
Carbonic oxide	3·31
Carbonic acid	1·04
Nitrogen (by difference)	82·50
	100·00

After cooling, by traversing a long flue in contact with the walls of boilers, the gas presented the following composition:

Oxygen	7·65
Carbonic oxide	3·21
Carbonic acid	7·42
Nitrogen (by difference)	81·72
	100·00

The author explains that the large increase of carbonic anhydride, shown in the latter analysis, is due to the further combustion of a quantity of finely divided carbon which is present in the atmosphere of the hearth furnace. M. Cailletet believes that it will be possible to utilize the large quantity of combustible material which ordinarily leaves the chimney with the cooled gases.

Physical Education for Girls.

In these days, when so many women are engaging in intellectual pursuits of a high character, and even are desirous of competing with men in the cares and anxieties of professional life, the question of their physical training ought to receive more attention than it has hitherto done. In this respect girls stand at a great disadvantage as compared with boys. Up to a certain age, say eight or nine, a girl mixes often on equal terms with her brother in his sports, indeed not infrequently excels him both in skill and spirit; but after that age healthy exercise is sacrificed to the bondage of genteel deportment. The growing child is confined with stays, and her feet crippled with tight boots. Anything like vigorous muscular movements are thus rendered impossible, and the sole exercise is the torpid regulation walk. Owing to this want of functional activity of the muscular system the muscles waste and dwindle, and the nutrition of the body becomes impaired. Many of the troubles women suffer from in later life are undoubtedly due to impaired muscular vigor, and much suffering would be spared if proper attention were paid in early life to their physical development by a course of systematic training. We do not mean that our daughters should emulate their brothers in the cricket field, or that female athleticism should become the vogue. But we would point out to parents and managers of schools the danger entailed by the present neglect of exercise, and indicate the games that could be most easily adopted. Thus fives, rackets, and lawn tennis are games for which no great space is required; the latter game might be taught systematically, just as cricket is to boys at public schools. To play these games with safety, however, stays and tight boots must be altogether discarded. Swimming, too, ought to be taught at all girls' schools, not merely because of the protection it affords, but also from its being in itself an admirable exercise, bringing into play all the muscles of the body.—*Lancet.*

The Palace Stock Car Company.

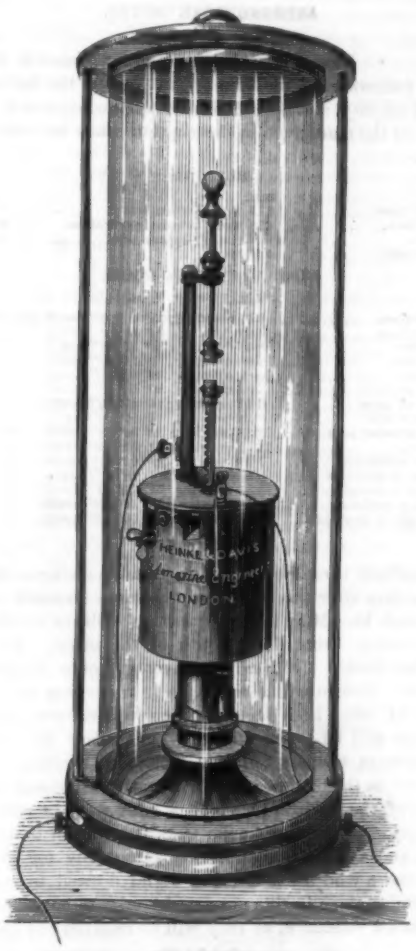
The Palace Stock Car Company, or a corporation spoken of by that name, which is said to have bought up all the patents (62 in number) for stock cars which provide for feeding and watering the animals *en route*, has one of the most beautiful plans for making a fortune by act of Congress that the heart of man ever conceived. It has caused a bill to be introduced into Congress, providing that unless cattle are carried in its "palace stock cars," they shall be unloaded and fed every 24 hours—a considerably shorter period than is now required and practiced, and for which all the arrangements of the railroads—the costly stockyards, etc.—are designed. This was an ingenious plan, for it made an appeal to humanity, which is apt to be listened to without taking pains to ascertain whether it would be really humane to grant what is asked in the name of humanity; and cattle shippers are not likely to be credited with any tenderness for their dumb property, while railroad corporations, having no souls, of course cannot have hearts. If the value of cattle for meat was improved by a course of starvation and exhaustion, there might be some necessity of interference by the government; but it has always been held out by the owners of "palace stock cars," that many times the cost of using them is saved by the better condition and heavier weight of the animals on arriving at market. And there is no doubt that hunger and thirst and prolonged weariness do reduce the weight of animals and injure the quality of their meat, and (which is a fact that the hardest-hearted cattle dealers can feel to the very bottoms of their pockets) reduce their market price. For this reason the men who own the cattle which they are transporting are interested more than any one else can possibly be in their humane treatment. And yet, strange to say, they could not be induced to adopt the "palace stock cars," though for years they have been urged to do so. Indeed, they assert that to use them would be inhuman; that the animals suffer more from confinement and exhaustion in a run of 80 or 100 hours in a "palace" stock car, where they are offered food and drink, than in a run of 30 or 40 hours in an ordinary car, with rest and refreshment on the solid earth thereafter; that food and drink do the cattle little good in their excited condition when running; and that, as the business is actually conducted, the suffering of the animals is not great, as the very small number of deaths *en route* indicates.

A large number of prominent railroad men have been in Washington to appear before the House Committee (on Agriculture, we believe) in opposition to this bill, and they are convinced that this committee will report against it.—*Railroad Gazette.*

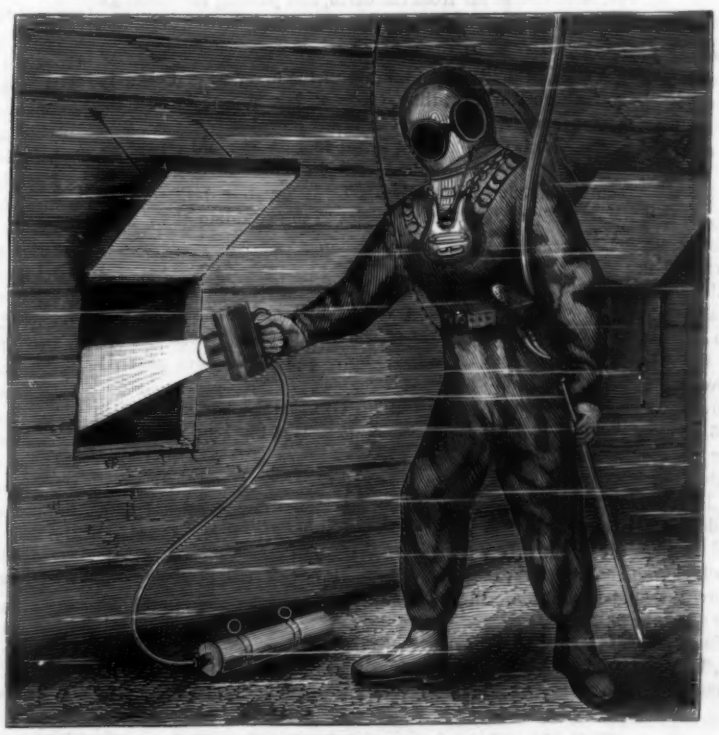
THE annual lumber product of the country is placed at 10,000,000,000 feet, a considerable portion of which is intended to replace timber cut only a few years previously, which has decayed. It is said that the renewal of telegraph poles alone requires 43,620,000 feet, a quantity nearly equal to the product of Maine.

SUBMARINE ILLUMINATION.

The conditions to be observed in the construction of lamps for giving light under water are many and difficult. Such lamps, like those used in an explosive atmosphere, must of course be isolated from the surrounding medium. There is also the additional requisite that, for a given degree of illumination, a greater intensity of light is needed to pierce the denser fluid. It is evident that there are strong objections against the use of ordinary gas or oil lamps for submarine illumination. They require an extra pump for their air supply, as much hose as the diver, and also as many men to attend to them; so that, for a necessarily feeble illuminating power, not only is the first cost considerable, but the working expenses are heavy and continuous. The cumbrous attachments are also a drawback.



ELECTRIC SUBMARINE LAMP.



OXY-CARBON SUBMARINE LAMP.

Two modes of overcoming these difficulties are shown in the accompanying engravings. In one apparatus, that of Messrs. Heinke & Davis, the problem is solved by the aid of electricity. This light will burn below water without any air whatever; and it is stated by *Iron* that when the parts of the lamp are screwed together no further attention is required. The upper illustration on this page shows the construction of this apparatus. The strength of the electric light allows the substitution of a glass cylinder for the usual bull's eye lens and reflector, and thus a uniformly diffused light is produced. The cylinder is fitted to a segmental ring, and can be removed by turning it to the extent of one eighth of the circumference. The lamp is made of polished brass, the top and bottom portions being connected together by strong brass rods. A plate of lead at the bottom gives the necessary weight to balance displacement, and also causes the lamp to sink and remain steady when placed on the bottom. The lamp may be burnt continuously or intermittently, as required by the nature of the work; the carbons are usually arranged so as to last about four hours without renewal. Electricity is supplied by a battery of from twenty to forty Bunsen's elements, according to the intensity of light required. The bottom of the lamp is fitted with stuffing boxes, by means of which the wires connecting the lamp with the battery may be connected or disconnected at will, without the necessity of severing the wires. The total weight of this lamp, which gives a light equal to 20,000 normal candles, is about 60 lbs. It may be used independently of surface connection.

Another plan is that of Messrs. Barnett & Foster, who use the system represented in the lower engraving. The light consists simply of the flame of a spirit lamp, urged by a jet of pure oxygen, compressed in a wrought iron bottle to about thirty atmospheres; and when one remembers what brilliant coruscations are produced by incandescent charcoal plunged in oxygen, it will readily be conceived that such a light is exceedingly powerful. This arrangement possesses the advantage of being entirely self-contained, dispensing with all pipes and connections from the surface. Exit valves are provided for the gaseous products of combustion, and the oxygen receiver is fitted with a rope, by which a diver can sling it on his back and walk about with it easily. The ordinary supply of materials will furnish a brilliant light for four hours.

New Inventions.

Mr. Jonas Hobbs, of Nineveh, N. Y., has invented an improved Wagon Standard, the object of which is to prevent jarring and jolting. The standards are inclosed by coiled springs, which support the wagon body, and have curved braces suitably secured.

An improved Fountain Pen for Marking has been invented by Mr. Joseph Schneider, of La Fayette, Ind. A detachable shank on the handle carries a stationary plate for one half of the pen, and a hinged blade for the other, the two blades being lined with cloth and curved downward toward each other, so as to form a fountain for the ink, as in drawing pens. The space between the points is regulated by a screw and counteracting spring.

A new Paper File, the invention of Mr. J. H. Van Pelt, of New York city, has two clamping strips, which are drawn together so as to hold the papers by pivot levers worked by screw nuts, which latter are turned by a longitudinal screw rod and key.

A novel Spacing T-Square for draughtsmen has been invented by Mr. Joshua D. Day, of New York city, which has a head in two parts, one fixed and the other movable, and an adjusting screw for limiting the motion of the movable part, together with a graduated scale for indicating the distance between the lines to be ruled. The parts may be so secured as to act as a common T-square, or the blade may be locked at any angle with the head, the angle being indicated by an index and graduated arc; or the blade and the part of the head to which it is attached may be moved over regular intervals, gauged by the milled nut and sliding scale, for ruling, shading, or spacing in a parallel direction at any angle. The working faces of the head are lined with chamois leather or rubber, to prevent the square from sticking to the board and at the same time produce the necessary adhesion. D. T. Ames, 205 Broadway, New York, will give further information.

Mr. John Krapp, of Brooklyn, N. Y., has invented an improved Spring Rocking Chair, in which the chair itself is separate from the base, and its rockers act upon stationary rounded and grooved bars on the base. The springs are two wire loops, having coils to give greater elasticity, and are clamped to the base and secured to the chair by hooks. An arrangement of pins and stop hooks limits the longitudinal motion, and lugs upon the rockers fitting into notches in the stationary bars prevent lateral motion.

A Support for Hose Nozzles, so constructed as to permit the stream to be directed at any desired angle, is the invention of Mr. Chas. H. Rodig, of Cleveland, Ohio. It has, on a standard, a ball and socket joint, to which the nozzle is clamped, and arrangements for securing the joint in a fixed position.

Mr. J. S. Halsey, of Lebanon, Ohio, has patented a Carbonic Acid Generating Apparatus applicable to the hose of fire engines, which injects the gas into the stream of water in its passage from the engine to the fire, the apparatus being designed to fill the place of a chemical fire engine.

Mr. J. H. R. Prall, of Elmira, N. Y., has patented a Device for Adjusting Transoms. The inventor employs a connecting rod, sliding in a slotted guide tube, and operating, by a pivot arm, the fixed arm of the sash or transom.

An improved Sash Stop, invented by Mr. Wm. T. Doremus, of New York city, prevents windows from being opened without being previously unfastened, and fastens the sashes automatically as they are lowered, thus guarding against the possibility of closing the window and leaving it unfastened.

A liquid Size for Calcimining has been patented by Mr. Wm. S. Welch, of Westfield, N. J., intended to take the place of the liquid glue in use. It consists of a solution of a vegetable gum and glue in boiling water, mixed with spirits of turpentine.

Mr. Henry Knowlton, of Flint, Mich., has invented a Door Stop and Holder, for retaining a door, when opened, in an easy manner and preventing jar. A cup-shaped rubber socket, attached to the door, receives a conical stop, which is screwed to the floor or base board.

Mr. J. D. Tatem, of Ayer Junction, Mass., has invented a Folding Desk, having a leaf hinged to a frame, with eyes by which it may be hung from hooks projecting from the wall, the leaf being supported when in use by a hinged brace, which may be folded inward, so as to permit the leaf to drop when not in use.

Mr. Isaac Scheuer, of New York city, has patented an improved Traveling Bag, in which the flap of the outside pocket is kept in place and shape by metallic straps, and the flap itself is secured by a novel fastening.

An improved Harness Pad has recesses at the back for receiving the nuts by which the terrets are fastened to the tree, and countersunk holes for receiving tufted screws for fastening the pad to the tree. The pad is made of rubber, and is the invention of Mr. H. R. Ridgley, of Ashland, Ohio.

An improvement in Photographic Vignetting Devices has been patented by Messrs. F. H. Price, of Irvington, N. J., and A. S. Campbell, of Elizabeth, N. J. The patent covers an adjustable vignette shield, in combination with a box for shading it.

Mr. J. L. Dodge, of Greene, R. I., has invented an improved Horseshoe, so constructed as not to ball with snow and to permit the calks being easily removed when the horse is in stable, or for replacing worn calks with new ones. The shoe is made in two parts, the lower one, corresponding to the common horseshoe, being secured to the upper by studs and a screw.

A Time Signal, invented by Mr. J. A. de Macedo, of Leeds, Eng., is a sand glass mounted on a horizontal axis in such a manner as to overbalance when the sand, or any fixed portion of it, has run from the upper bulb to the lower. On the upper part of the glass is a hammer, which when the glass overturns strikes a bell hung beneath.

A Ventilator for Windows, invented by Mr. L. D. Harvey, of Sheboygan, Wis., has a curved metallic deflector, with cloth side pieces, and is provided with a hinged cover which may be adjusted in any desired position.

Mr. H. W. Hammersmith, of South Bend, Ohio, has invented an improved Rail Joint, or vise for connecting broken rails. It consists of a jaw, bearing upon the fish plate at one side of the joint of the rails, and extending in the shape of a bolt below the base to a second jaw, which is secured by a screw nut on the end of the bolt, so as to bear tightly on the opposite fish plate.

Progress of Atlantic Steam Navigation.

LIVERPOOL ENGINEERING SOCIETY.—This Society held its usual fortnightly meeting at the Royal Institution on January 30. Mr. Arthur J. Maginnis read a paper on "Atlantic Lines and Steamships." The author briefly sketched the development of the now enormous Atlantic trade of Liverpool from its commencement, in 1840, when Sir Samuel Cunard dispatched the Britannia from Liverpool to New York, to the end of 1877, when there were 152 British steamers, with an aggregate tonnage of 377,905 tons, engaged in this trade. After enumerating the different companies which have been formed from time to time, and giving a short history of each, Mr. Maginnis proceeded to give some interesting statistics of the engine performances of the more famous vessels. We find that, owing to the improvement in modern vessels and engines, a ton of cargo can now be delivered in New York with the consumption of 4·5 cwt. of coal on the voyage against 48·5 cwt. in the earlier class of steamers; and the consumption of coal per indicated horse power of the engines has decreased from 4·7 to 1·9 cwt., while the average speed per hour has been almost doubled.

Attention was called to the compound inverted engines introduced in the vessels of the White Star line, each engine having a high and a low pressure cylinder as a precaution against a break down. The author endeavored to allay the prevalent anxiety where a vessel disabled her machinery, for, having sailed over 800 miles in a disabled steamer, he could testify to the good sailing qualities of most of our ocean-going steamers.

The African Musket.

The gun known in the Birmingham trade by this name has changed neither its quality nor pattern for many years past. These guns are sent to the West Coast of Africa, where they are interchanged for palm oil and other produce. But a few years back no ship's cargo trading with that coast was complete without a supply of them. The taste of the African is fickle in the matter of beads; a shade of color which is in demand one season may be unsalable the next; but it is not so with guns, wherein he rejects all improvements, and rigidly adheres to the old flint musket, with its bright barrel, which his father and his grandfather used before him. There are various patterns of these African guns, as each district has its own peculiar taste. The barrels vary considerably in length, and are variously stained, some black, others a brown-red, and others again a bright vermilion. Probably 100,000 to 150,000 of these guns made in Birmingham are annually exported.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, March 9, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	6 13 mo.	Saturn sets	6 11 eve.
Venus rises	4 51 mo.	Uranus in meridian	10 45 eve.
Mars sets	11 27 eve.	Neptune sets	9 47 eve.
Jupiter rises	4 12 mo.		

FIRST MAGNITUDE STARS.

	H.M.	Amplitude.
Antares rises	0 55 morning,	35° 35′ 12″ south of east point.
Regulus rises	4 08 evening,	16° 41′ 08″ north " "
Spica rises	8 45 evening,	13° 57′ 26″ south " "
Altair rises	2 08 morning,	11° 18′ 52″ north " "
Vega rises	10 28 evening,	55° 32′ 11″ north " "
Algol (var.) sets	1 02 morning,	58° 57′ 10″ north " "
Aldebaran sets	0 20 morning,	21° 41′ 36″ north " "
Alpheratz sets	8 42 evening,	38° 54′ 06″ north " "
7 Stars (cluster) sets	11 58 evening,	32° 04′ 53″ north " "
Rigel sets	11 29 evening,	11° 01′ 34″ south " "
Sirius in meridian	7 30 evening,	22° 04′ 47″ south " "
Procyon in meridian	8 23 evening,	7° 18′ 37″ north " "
Arcturus in meridian	3 08 morning,	26° 34′ 30″ north " "
Capella in meridian	5 58 evening,	71° 17′ 00″ north " "
Betelgeuse in meridian	6 39 evening,	9° 46′ 49″ north " "

REMARKS.

Fomalhaut is omitted in the above table owing to the fact that he rises after and sets before the sun. Venus is stationary March 13. Mars is in conjunction with the moon at 9h. 8m. evening, being 4° 16′ south of the moon. Professor Hall has named the newly discovered moons Deimus and Phobus. Saturn will continue to be "evening star" until March 13, when he is in conjunction with the sun, and after that date will be "morning star" until June 23. Algol is at minimum brilliancy March 6, 6h. 25m. evening. "Amplitude" is the distance north or south of the east or west points of the horizon at which a body rises or sets. It is much easier to find particular stars if we know their amplitudes, and as this does not vary perceptibly for short periods, those who are observing would do well to copy the amplitudes given in this number, in order to have them convenient for reference, as they will be inserted but once.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations of the following notes, which are merely approximate, have been made by students in the Astronomical Department of Vassar College.

Position of Planets for March, 1878.

Mercury.

On March 1 Mercury rises at 6h. 11m. A.M., and sets at 4h. 19m. P.M. On the 31st Mercury rises at 6h. 12m. A.M., and sets at 7h. 15m. P.M.

Mercury is at superior conjunction with the sun on March 20, is of course far from the earth, and passing the meridian at the same time with the sun.

Venus.

Venus, which in the evenings of the first part of February was a beautiful threadlike crescent, has passed west of the sun and can in March be seen in the morning.

On March 1 Venus rises at 5h. 26m. A.M., and sets at 4h. 55m. P.M. On March 31 Venus rises at 3h. 57m. A.M., and sets at 2h. 59m. P.M. Venus is at greatest brilliancy on March 28; at that time it comes to the meridian at 9h. 31m. A.M.

Mars.

Mars is so distant that it has become much less marked than when at opposition in September. But its path in March is so nearly that of some of the bright stars of the Pleiades as to make it again noticeable. It passes near Alcyone on the 15th.

Mars rises on March 1 at 9h. 17m. A.M., and sets at 11h. 35m. P.M. On March 31, Mars rises at 8h. 18m. A.M., and sets at 11h. 14m. P.M.

Jupiter.

Jupiter can be seen in the morning. On March 1 Jupiter rises at 4h. 41m. A.M., and sets at 2h. 1m. P.M. On March 31 Jupiter rises at 3h. 0m. A.M., and sets at 0h. 30m. P.M.

Jupiter is far south in declination and rises so short a time before the sun that few observations can be made in this latitude.

Saturn.

Saturn is in March so nearly in range with the sun that it is useless to attempt observations upon it. Since September the large telescope of Vassar College has been turned, nearly every fine evening, to this planet. Drawings of Saturn, its ring and its many satellites, have been made on forty-four evenings. At first the ring was a narrow ellipse, narrowing from night to night, then a mere line of light across the planet and projecting beyond it, and on February 7, when last seen, it was as broken points of light.

In the autumn six of the satellites were sometimes seen, the largest Titan and Japetus, and the smaller ones Rhea, Dione, Tethys, and Enkeladus. As Saturn became more distant the smaller ones, Enkeladus and Tethys, ceased to be seen, and on February 7th Titan, Japetus, and Rhea only were visible.

The ring of Saturn reappears in March, the southern side being presented to view in the morning hour. But its rising is so nearly that of the sun that it cannot be seen before April.

On March 1 Saturn rises at 7h. 13m. A.M., and sets at 6h. 36m. P.M. On March 31 Saturn rises at 5h. 23m. A.M., and sets at 4h. 57m. P.M.

Uranus.

The only planet which is well situated for observation in March is Uranus. On March 1 Uranus rises at 4h. 29m. P.M., and sets at 6h. 7m. of the next morning. On the 31st Uranus rises at 2h. 26m. P.M., and sets at 4h. 6m. of the next morning.

Uranus is still near Regulus, but has moved toward the west and is in higher northern declination. A small telescope of two or three inches object glass will show the disk of Uranus; Regulus and the planet will probably come into the field together, if a low power is used. Little can be seen of Uranus even with a large telescope. Its disk is of a dull greenish white color, and its moons are mere points of light difficult to follow.

Neptune.

Neptune is very distant and keeps nearly the diurnal path of the sun; it is useless to attempt to find it.

Chemical Notes.

Formic acid has recently been found to possess powerful preservative properties, exceeding, when added to acid solutions, even carbolic acid; and to be particularly suitable for adding to fruit juices. From ¼ to ½ per cent is the quantity requisite to preserve vinegar, fruit juices, glue, ink, etc.

Thymol appears to be attracting considerable notice, and the demand for it is steadily increasing. For offensive wounds a strong alcoholic solution is recommended. The saturated aqueous solution is capable of arresting lactic fermentation, and arrests excessive secretion by mucous membranes.

Polyporic acid, with the formula $C_7H_8O_3$, is the recent discovery of Stahlschmidt from the analysis of several species of toadstools belonging to the genus *polyporus*. The new acid is insoluble in water, and gives well defined compounds with the alkalies, forming purple colored solutions.

Bolivite is a name given by Domeyko to an oxysulphide of bismuth which he has found in Bolivia; it is composed of the sulphide Bi_2S_3 and the oxide Bi_2O_3.

He has also found *taznite*, a chlorarsenate and chlorantimoniate of bismuth, in Bolivia.

Bichromate of potash as an antiseptic.—M. Laujorrois lately presented a note to the French Academy on the antiseptic properties of bichromate of potash. Experiments had shown him that the addition of one hundredth part of the bichromate in ordinary water prevents the putrefaction of all sorts of organic matter, such as meat, urine, etc. A thousandth part of bichromate prevents beer from turning sour. After three months' immersion in a solution, meat was hardened and dry.

Iodous acid has been obtained by Ogier by placing iodine in contact with ozone at a temperature of 44° to 50°. It is a pale yellow, light powder, decomposable by water with the deposition of iodine. On the other hand, *iodic* acid is apparently obtained when ozonized oxygen acts upon iodine vapor, or when a mixture of iodine vapor and oxygen is exposed to the silent electrical discharge. This iodic acid is a colorless body, soluble in water without decomposition. It was accompanied by what appeared to be *hypoiodic acid*, a body less soluble in water and with characters reminding one of the hypoiodic acid described by Millon.

The Analysis of Sugar.—In a paper on this subject, read before the Chemical Society, the author, G. Jones, proposes to estimate *sucrose* volumetrically by adding a 0·1 per cent solution to a decinormal solution of permanganate, acidulated with sulphuric acid, until the dirty brown hydrated peroxide of manganese, which is at first formed, is reduced and dissolved. The solution, contained in a porcelain dish, is boiled after each addition of the saccharine liquor. The author states that in every case he obtained results which fully justify him in calling attention to the process. The coloring matter in sugar does not seem to affect the value of the estimations. Mr. Waring drew attention to the fact that this use of permanganate must be limited to cases in which the sugar was tolerably pure, and that it would be useless for the determinations of the sugar present in the juice of the beet root, etc.

Solubility of Sugar in Water.—Courtonne finds that at 12·5°, 100 grammes of water dissolves 98·547 grammes of sugar, and at 45°, 245 grammes; in other words, a saturated solution of 12° holds 66·5, and one of 45° 71 per cent of sugar.

Inventions Patented in England by Americans.

From January 11, 1878, to January 14, 1878, inclusive.

AERO-STEAM ENGINE.—E. M. Strange *et al.*, New York city.
BOOT AND SHOE MACHINE.—J. W. Brooks, Boston, Mass.
CAR AXLE.—N. Jones, Syracuse, N. Y.
CENTRIFUGAL MACHINE.—W. H. Tolhurst, Troy, N. Y.
ELECTRIC LAMP.—W. Wallace, Ausonia, Conn.
FENCE.—Empire Wringer Company, Auburn, N. Y.
FILE-CUTTING MACHINE.—A. J. Dobson *et al.*, New York city.
GOVERNOR.—H. T. Farnsworth, Bellefonte, Pa.
LADLE FOR METAL FOUNDING.—W. Fawcett, Omaha, Neb.
MAGNETO-ELECTRIC APPARATUS.—J. J. McTighe, Pittsburg, Pa.
PAPER PULP GRINDING CYLINDER.—C. J. Bradbury, Lawrence, Mass.
PEAT, PREPARING FOR USE.—W. E. Wright, Rome, N. Y.
POSTAL CARD.—F. W. Brooks, New York city.
RASP-CUTTING MACHINE.—A. J. Dobson *et al.*, New York city.
STEAM BOILER.—J. Baird, New York city.
SUPERHEATING STEAM.—T. S. C. Lowe *et al.*, Norristown, Pa.
TELLURION.—C. M. de Percival, New York city.
WIND INSTRUMENTS.—C. G. Conn *et al.*, Elkhart, Ind.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Notes & Queries

(1) T. C. asks: 1. Is the Trouvé moist battery to be used on a closed circuit like the bluestone batteries, or an open one? A. It may be used with almost equal advantage for either. 2. Does it require renewing? A. It has of course to be renewed at periods of time dependent upon the amount of use. It is called a constant battery to distinguish it from batteries which require more attention.

(2) A. B. C. asks: Is there anything manufactured or patented to prevent cellars or basements from being flooded with water? A. There are many devices. The inclined heavy brass gate valve may answer your purpose. Several patents relating to this subject have recently been issued.

(3) J. D. B. wishes to know how to make a dry pit for his elevator. He has used a plank box without success. A. Pump out the box as dry as possible and calk the joints with strips of cotton cloth saturated with lead paint. If this should not succeed, construct the pit of brick, line it with several coats of asphaltic cement, and then lay a course or so of brick in the bottom to keep the asphalt in place.

(4) C. H. M. asks: 1. What is the advantage of using two sizes of wire in the same helix; does combining the two increase the inductive power? A. No; both helices or spools are wound in the same direction. Two sizes of wire are seldom used in constructing an ordinary helix or coil, such as is used on a simple electro-magnet. The induction coil, such as is used for giving shocks by electro-magnetism, consists of two coils, one of coarse wire, called the primary coil, which is connected with the battery, and the other of fine wire, each end of which is connected with a hand of the person for the purpose of giving shocks of electricity, produced in it by induction from the primary coil and its iron core. 2. What is the formula or proportional law between the size and character of the helix as compared with the magnet upon which it is placed in order to obtain the greatest inductive power? For instance, suppose a cylindrical magnet 6 inches long and 1 inch diameter, what should be the diameter of the helix to obtain the maximum induction? A. In the case you suppose, the diameter of the helix or spool should be about 3 inches; that is, the diameter of the core should be about 1/3 of the diameter of the spool, and, conversely, the diameter of the spool should be about three times the diameter of the core.

(5) W. M. L. writes: 1. How can I properly charge a large permanent magnet of horseshoe shape? I made one 2 feet 6 inches long, of three thicknesses of 1/8 inch steel, 2 1/2 inches wide. I tempered the ends hard, and wound it with covered copper wire; but could not magnetize it with 30 cups of battery any more than if I had simply rubbed it on another magnet. A. To properly charge a magnet of the size you describe would require the use of a very powerful battery and electro-magnet, on the poles of which the steel to be magnetized would have to be laid in such a manner that the magnetic circuit would be completed through it. 2. How many parts should a magnet of this size have? A. It should be built of layers of steel 1/8 of an inch thick.

(6) J. J. T. asks: Will an iron ball roll down an incline in a vacuum faster than in the air? A. Yes.

Which is the better plunger pump, a horizontal or vertical one? A. The vertical pump is generally preferred in cases where it is worked by hand, but the question of preference is based almost entirely on the circumstances under which the pump is to be used.

(7) C. W. W. asks: How can I make a permanent magnet with a horseshoe magnet? A. If you wish to make a hardened steel bar magnetic, draw one end several times in one direction, over one pole of the horseshoe magnet, and draw the other end of the bar in a similar manner over the other pole of the horseshoe magnet.

(8) C. B. asks: What is the proper name for those brass or wood slide blocks which are set in a crosshead and work on guides? A. They are generally indicated by the name you mention.

What is meant by "wire drawing?" A. Reducing the diameter of wire by "drawing" or pulling it through a hole of less diameter than its own diameter.

(9) F. S. T. asks: What will be the simplest mode of constructing a short telephone line, of 50 rods or less, and how should the wire be insulated? A. Glass is the material most generally used for this purpose. You can insulate your main line by supporting it on the ordinary glass insulators which are in use on most telegraph lines, or you may improvise an insulator by using the necks of broken bottles mounted on hard wooden pins, driven into the poles or trees, and securing the main line to each bottle neck in succession, by means of a short piece of wire twisted tightly around the bottle neck and the main line.

(10) A. J. H.—The eggs you send are those of the common bark louse of the apple tree (*Aspidiotus conchiformis*). The female is shaped like an oyster shell. The males are broad, with wide wings and a central appendage, but without the usual caudal filaments. The puparium has a double shield. The insects do great injury to the trees. Consult Hill's "Insects Injurious to Vegetation," and Packard's "Study of Insects," pp. 528-31.

(11) C. J. W. asks: Is there any substance which, applied to silk or paper, will form a nearly perfect non-conductor of magnetism when placed between a permanent magnet and a piece of soft iron? A. No.

(12) W. S. D. asks: 1. Will the telephone work on a telegraph wire having 2 sounders on, with different sized magnets? A. Yes. 2. How many cells of a gravity battery will be required to work 4 sounders on a telegraph line 300 feet long? A. About 3 cells. 3. Will a lightning rod make a good ground wire? A. That will depend on the size and conductivity of its earth connection. 4. Does it require more battery power to operate sounders of a different number of ohms? A. Yes.

(13) L. H. M. asks: Will it be practicable to make an electrophorus by pouring ordinary sealing wax into a 12 inch tin plate with raised margin, and using a tin disk with insulating handle for the movable plate? A. Yes, but the diameter of the tin disk must be less than the diameter of the other plate.

(14) D. F. H. asks: Can I, by running wires from my house to the shop, a distance of about 125 feet, light the fire under the boiler at the shop by electricity from the house, using a fuse like those used for blasting? A. Yes, although some combustible substance would have to be used in connection with the fuse, as the flash produced by it would be perhaps too sudden to light the shavings or paper used in kindling the fire. A mixture of phosphorus and sulphur would no doubt answer the purpose if used with care, to prevent accidents.

(15) H. C. B. writes: 1. I am informed that, where a battery is used on a Bell telephone line, connecting the wrong pole of the battery with the telephone will weaken and eventually destroy the power of the magnet even where the telephone is only let into the line when in actual use. If this is so, what is the proper way to connect a line from a Callaud battery through the "vox" telephone? A. Connect the battery so that the passage of its current through the spool of the telephone magnet will tend to increase its magnetism, as may be seen by the variation of a magnetic needle placed in its vicinity. 2. For an ordinary telegraph line, 1 to 5 miles in length (ground circuit), containing from two to six 5 inch electrical bells, what would be the proper resistance for the bell magnets? A. About 12 ohms each. 3. About how much Callaud battery would be required to work the bells well for signaling by single stroke? A. About 30 cups. 4. Could they be worked properly on a line 15 miles long without local battery and relay? A. Not properly, as it would be expensive to use such a large main battery as would then be required.

(16) J. E. M. writes: 1. I have seen the description of a condenser (for induction coils) in the SCIENTIFIC AMERICAN for November 25, 1876, vol. 35, No. 22. Will you tell me if one made of 30 and 31 sheets of foil 12 inches x 8 inches would be a good proportion? My coil is made with 2 lbs. of No. 22 cotton covered wire well insulated for secondary. The coil works very well now, but I suppose a condenser would improve it. A. Yes. 2. Will you please tell me how the condenser is to be connected in the circuit with coil? A. Connect one terminal of the condenser with the commutator post of the coil, and the other terminal of the condenser with the post that supports the vibrating armature.

(17) L. D. asks: 1. How is a Smee battery made? A. It consists essentially of two plates of amalgamated zinc, held by a metal clamp, so as to face each other, forming the negative pole of the battery; and a plate of platinum or silver, supported by an insulation, placed between the zinc plates forms the positive pole. The exciting fluid consists of about 10 or 15 parts of rain water to 1 part of sulphuric acid. 2. Is any change made in the battery when plating with gold, silver, nickel, etc.? A. Not unless the plating is done on a very large scale. 3. Is it necessary to use pure metals for plating? A. It is best to have them pure in order to produce a given result. 4. Are the metals treated with anything before using? A. No.

(18) A. C. N. says: Will the SCIENTIFIC AMERICAN kindly inform me whether there is any arrangement, simple and inexpensive, whereby the peculiar exercise afforded by horseback riding may be obtained within doors? A. Perhaps some of our readers can make a suggestion in reply.

(19) L. A. G. asks: 1. How can I make a telephone? A. On the pole or poles of any form of electro-magnet, of which the core consists of a bar, or U-shaped permanent magnet, lay a small disk or sheet of very thin iron or common tin. Inclose the whole in a cardboard cone, the small end of which is open, and is placed in the ear so as to act as a speaking trumpet, to convey the vibrations of the thin sheet of iron or tin, which faces it, to the drum of the ear. This completes one telephone, for one end of the line, and the other telephone, for the other end of the line, should be made just like it; and the wire which forms the electro-magnet should be of the same diameter and length in one instrument as it is in the other. 2. How can I attach a telephone to a telegraph wire 3 miles from any office, so that I can read what goes over the line? A. By tapping the main line; connect one end of a short piece of wire with the main line, and connect the other end of the short piece of wire with one binding post of the telephone, then connect the other binding post of the telephone with the ground. 3. Can we use 2 telephones to converse with over 3 miles of railroad telegraph line? A. Yes.

(20) J. L. S. asks: What tool shall I use to point No. 10 wire to 1/8 inch, with a taper of 1 1/4 inches? A. A properly shaped turning tool used in a slide rest set to the required angle will answer your purpose.

(21) A. J. asks: 1. Can anything be added to sulphate of copper solution, which will cause the copper coating deposited on iron to retain its color when exposed to air? A. No. 2. How can iron be colored like copper? A. Reduce 3 ozs. of copper sulphate to powder and dissolve it in a quart of hot water. Pickle the articles in dilute oil of vitriol or acid zinc chloride. 3. Please give me a recipe for bronzing iron. A. For an ordinary bronze, give the article a good coating of copper, and while hot wash over it a little acetic acid very nearly neutralized with ammonium carbonate in the cold.

(22) D. E. B. asks: Can the ordinary Bell telephone be used on a telegraph line without interfering with, or being interrupted by, the regular telegraphic messages? A. There is an inductive effect produced by the proximity of other telegraph lines running parallel with the telephone line, but this inductive effect may not, except in some cases, be regarded as a radical interference. Your question may refer to tapping the main line (see answer to L. A. G.). In that case, our answer is, no; but the greater the resistance of the wire on each telephone magnet, the less will be the interference with the Morse signals which are being transmitted over the line which is thus tapped.

(23) J. B. W. asks: Is there any process by which sandy soil may be cemented into a cheap fence? A. Hydraulic cement, good lime, tar, pitch, or resinous matters may be used, as in the preparation of artificial stone. The economy of a fence made in this way will, however, depend upon your interpretation of the word "cheap."

(24) H. S. asks: How can I remove ink stains or blots from paper? A. If the paper is not tinted use hydrochloric acid (chemically pure) applied repeatedly on clean blotting paper and absorbed by a little fine, dry pipe clay. If otherwise, you had better not attempt the removal. Use moist blotting paper to remove traces of acid.

(25) N. W. M. asks: 1. What is the best method of tempering cast steel bars? A. Heat them to a red heat and quench them until cold in water at about 60° Fah.; then polish a small part of the surface and reheat until the required temper color appears. 2. How are steel trap springs tempered? A. They are heated to a cherry red heat and cooled in water; then reheated in a mixture of oil and tallow in equal quantities; when this substance blazes freely on the springs they are allowed to cool off in the air. 3. Can malleable iron be welded to cast steel? A. We think not.

(26) S. W. F. writes: I see it stated that the temperature for hatching hens' eggs should be 140° Fah. Is that correct? A. Probably 104° is meant.

In winding an electro-magnet with uncovered copper wire, if cotton twine of the same size as the wire be wound with it at each turn, and a piece of silk be placed between the layers so as to keep the several parts of the wire from contact, will the insulation be sufficient? A. By winding the wire in the manner described, it would be well insulated, but the magnetic effect would not be so good, as you would not be able to wind as much wire in a given space as you could if the wire was covered with silk or cotton.

(27) A. J. W. writes, in answer to J. A. O., (48), February 16: I run my cotton press with a pair of friction wheels. The driver on the main counter is 4 feet, the one on press shaft 3 feet, both 8 inch face, the latter covered with a gum belt and thrown in contact with driver by a lever moving a sliding timber on which the press shaft box is fixed. It works well.

The same correspondent, referring to H. & T.'s inquiry as to the removal of soot from the top of boilers arched over with brick, makes the following suggestions: Let in a small steam pipe at the rear end of the boilers; put on a globe valve; attach a piece of steam hose and nozzle; fit a wooden lever to turn on the steam. By this arrangement the soot under the arches may be blown out during or after work.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. G. P.—No. 1 is a rich silver-lead ore—argentiferous galena. No. 2 contains iron sulphide, galena, and antimony sulphide.—J. C. W.—Impure fire clay, containing much organic matter. Worth about $1 per ton in this city.—F. M. H.—It is hornstone.—A. J.—The sample contains a notable quantity of argillaceous matter, but will answer well in mixture for some varieties of glass. It could probably be improved by washing.—S. R. R.—No. 1 is a very fine variety of silicious sand, of some value for common glass making as a flux in certain metallurgical operations, for artificial stone, etc. The clay (No. 2) contains too much silicious matter to be of especial value.—F. G. P.—It is partially decomposed marcarite in ferruginous clay.—J. A. U.—All four samples are metalliferous. The veins represented by Nos. 1 and 3 should be examined.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 29, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air, compressing, J. P. Frisell 199,619
Amalgamator, Le Clere & Cachot 199,724
Anchor, A. A. Stimson 199,574
Animal-feeding device, E. Sterring 199,573
Animal trap, A. H. Barber 199,775
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Bale-band tightener, Bull & Koch 199,617
Bale tie, Andrews & Edwards 199,678
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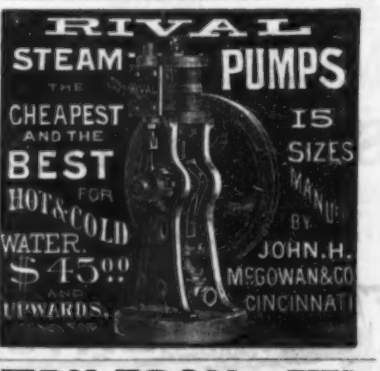

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